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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 1846
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1847
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1847
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1848
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1848
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1849
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1850
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1851
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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CONTRACT NUMBER INDEX I-89
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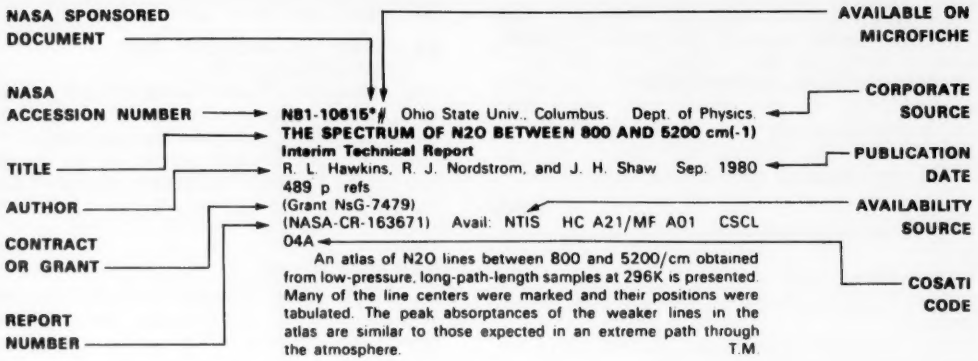
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere.
T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, REGENERATIVE ENGINE ANALYSIS
R.W. Heldenbrand, Garrett Corp., *402 S. 36th St., Phoenix, Arizona* 85034 (DA0G0505; DAAK51-79-C-0057)

The objectives are to identify promising heat exchanger concepts, and to conduct a preliminary design and analysis of a fuel efficient regenerative turboshaft engine suitable for helicopter application.

The effort will be conducted in two phases as follows: a. Engine parametric and heat exchanger design analysis. b. Regenerative engine preliminary design and configuration definition.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0002, SOLID STATE RADIO MAGNETIC/HORIZONTAL SITUATION INDICATOR (RMI/HSI)
B. Hoffman, Hughes Aircraft Co., Aerospace Groups, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0D3523; DAAB07-77-C-2194)

The objective of this task is the development of a digitally addressable, programmable, solid state RMI/HSI employing a flat panel display. This unit is intended to replace existing electro-mechanical devices and be compatible with new, in-development, digital sensors, processors and the MIL-STD-1553A(B) digital data bus.

Integrate a flat panel (solid-state) display, drive circuitry, programmable symbol generator, signal processor, and control unit to accept and display all appropriate RMI/HSI signals for demonstration and evaluation of feasibility for eventual incorporation in Army aircraft.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0003, DEVELOPMENT OF FLYING QUALITIES STANDARD AND HANDBOOK
I. Ashkenas, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF144940; F33615-80-C-3604)

This work unit supports an update of the military flying qualities requirements contained in MIL-F-8785B, Flying Qualities of Piloted Airplanes. The problem is that these requirements are not applicable to many advanced flight control concepts, so the requirements must be updated to correct these deficiencies. The objectives are to (1) revise the current requirements of MIL-F-8785B or formulate new criteria, as appropriate, and (2) reformat the documents into a MIL-standard and handbook. The payoff from this effort will be a consistent set of design and flight test flying qualities requirements that will allow new and advanced technologies to be incorporated into new aircraft systems developments in order to ensure mission success without penalties caused by overdesign.

An assessment of the state-of-the-art in flying qualities technology will be performed by reviewing new technical reports and papers. New data and criteria will be assessed for applicability and usefulness in either revising existing criteria or formulating new ones. These revised or new criteria will be incorporated into a reformat of the flying qualities specification into a MIL-standard and handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, RESEARCH IN AERODYNAMICS
I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0C5002)

The objectives are to exploit and apply state-of-the-art mathematics in support of laboratory research efforts. To develop a technology base in numerical analysis and computational techniques and to advance mathematics in areas of rotary-wing fluid mechanics applicable to airmobile R&D.

The approach consists of three major steps: (1) Maintain awareness of the development and disseminate state-of-the-art mathematics throughout the laboratory. (2) Exploit new techniques and methods for assimilating the results of complex, time-dependent computations for airmobile applications. (3) Conduct research in various applied mathematical topics which are relevant to Army needs. These objectives will be achieved largely through joint participation with NASA making maximum use of the facilities and expertise available within NASA with respect to computational fluid dynamics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0005, DIAGNOSTIC AND CONDITION MONITORING SYSTEM ASSESSMENT FOR ARMY HELICOPTER MODULAR TURBOSHAFT ENGINES (DA0E3870)
J. Saunders, General Electric Co., *1000 Western Ave., Lynn, Massachusetts* 01901 (DA0G0071; DAAK51 79 C 0020)

The objective of the effort is to assess the elements fundamental to the implementation of a diagnostic and condition monitoring concept to fault isolate to the module and line replaceable unit (LRU) level for Army helicopter modular turboshaft engines. The contractor is using the T700-GE-700 engine as the candidate modular turboshaft engine and is including applicable results from previously related Army contractual efforts.

The work is to be performed through the conduct of the following tasks: (1) Task I - Diagnostic and Condition Monitoring Approach Identification; (2) Task II - D&CM Hardware Development Requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0006, INTEGRATED FLIGHT TRAJECTORY CONTROL SYSTEM DEVELOPMENT PROGRAM B
M. Byrd, Lear Siegler Inc., *4141 Eastern Ave., Grand Rapids, Michigan* 49508 (DF144370; F33615-79-C-3624)

The Air Force function of this effort is to demonstrate the increased mission effectiveness of tactical aircraft through im-

plementation of the integrated flight trajectory control (AFTC) algorithms in conjunction with a projected map display (PMD) and a mission data transfer system (MDTS). The problem area of high workload and lack of situation awareness can be positively addressed using mission-oriented interactive control and display techniques. The enhanced simulation, addition of the PMD and MTDS, will serve to demonstrate direct application to current weapon system. This effort will demonstrate the direct application of technology toward verified tactical scenarios as a measure of improved mission effectiveness and survivability.

Install a projected map display and a mission data transfer system in the integrated flight trajectory control simulator and evaluate the benefits in workload reduction and mission effectiveness. The specific areas to be addressed are algorithm verification, operational application demonstration and system integration. Continued coordination with related programs and user organizations will insure compatibility and technology transition.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, EFFECTS OF DRIVING GAS TEMPERATURE ON EJECTOR PERFORMANCE

R. Dejneka, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, *1440 Pkwy. Ave., Trenton, New Jersey* 08628 (DN796800)

Determine the effect of driving gas temperature on ejector performance. Thrust augmenting ejectors appear to have a good potential for V/STOL and other low speed propulsion application.

A low volume ejector model which was developed by the Flight Dynamics Research Corporation will be tested at the Naval Air Propulsion Test Center (NAPTC) with driving gas at ambient, 400 and 800 F. Testing will be conducted at sea level, static conditions. Measurements will include: thrust, driving gas flows, and diffuser exit temperature and velocity profiles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0008, ATMOSPHERIC ELECTRICITY HAZARDS ANALYTICAL MODEL DEVELOPMENT AND APPLICATION

R.A. Perala, Electromagnetic Applications Inc., *Albuquerque, New Mexico* (DF143340; F33615-79-C-3412)

The work supports the overall mission of increased safety of flight of advanced technology aircraft in a lightning-threat environment. Induced electrical transients due to lightning can cause temporary disruption (upset) and damage of sensitive flight and mission critical electrical systems. The work will develop and apply analytical models of the threat environment and of the induced effects of lightning on electronic systems to assess the susceptibility/vulnerability of these systems. Costly retrofit hardening of equipments can be greatly reduced if systems are hardened in the development test stage before production.

The program consists of three interrelated tasks. Under Task I, limitations of present lightning arc channel models will be identified and more accurate lightning/aircraft interaction arc channel models for both the direct and nearby strike event will be developed. Under Task II, presently used indirect lightning effects testing methods will be evaluated and limitations identified. New test methods that adequately simulate the in-flight lightning/aircraft interaction for both the direct and nearby strike events using ground-based facilities will be investigated. Results of Task I will be used in establishing realistic simulation methods under Task II. Under Task III, limitations of present analytical models and computer codes that can be used to predict the external interaction, the penetrations, and the induced transient levels on aircraft electrical/electronic systems will be identified. New/improved electromagnetic coupling models and codes will be developed that can be applied to all types of aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, WING-STORE FLUTTER METHODS

R. Chipman, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890167; N00019-79-C-0062)

Evaluate effectiveness of using automated numerical search techniques to identify the most critical wing-STORE flutter conditions for realistically complex configurations.

Extend existing search algorithms to accommodate non-constant constraints on search parameters (STORE properties) and include STORE center-of-gravity locations and pylon flexibilities as additional search parameters. Compare analysis with wind-tunnel and flight data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0010, IMPROVED COMBUSTOR DOME

D. Bahr, General Electric Co., Aircraft Engine Group, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DN889814; N00140-79-C-0384)

Investigate the nature of hot streak formation which results in flow field regions of high fuel concentration contributing to high pattern factor and adverse boundary layer reactions as a function of the fuel injector harmonic producing a need for preferential liner cooling. Based on cold flow and burning and mixing test rig results, the influence of dome aerodynamics and dome geometry on stoichiometric profiles will be defined.

Highly instrumented single and multi-injector sector rigs will be used to qualitatively assess the mixing reaction; i.e., the manner of fuel entrainment in a strong airflow pattern. Cold flow tests will be followed by quantitative measurements in a hot rig.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.001, COMBUSTION SYSTEM REMOTE MEASUREMENTS

W.M. Roquemore, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458220)

The objective of this program is to apply instrumentation which can measure temperature and specie concentration within chemically reactive zones of practical combustion devices.

Previous investigations have substantiated the feasibility of catalytic combustion at conditions simulating high-power operation of a gas turbine engine. This program will expand the data base for catalytic combustion in both low- and high-power modes through experimental investigations conducted in Room 20, BLDG 18C (see Work Unit 30480542). The ability of a catalyst to ignite and promote the combustion of a fuel/air mixture in an afterburner will be experimentally investigated in a J85 gas turbine engine mounted on Test Stand C, BLDG 71A (see Work Unit 30660532). To expand the basic knowledge of catalytic combustion processes, a fundamental research program will investigate the surface reactions on a catalytic flat plate in a combustion tunnel installed in Room 20, BLDG 18C (see Work Unit 30480542).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0012, QUIET PROPELLER CONCEPT EVALUATION

P.A. Shahady, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451910)

The objective of this program is to evaluate the noise characteristics of various tail rotor configurations to determine the noise reduction potential of various new designs. Variables to be investigated include number of blades, blade to hub-phasing angles and blade length.

This exploratory research program is divided into three phases as follows: Phase I - Analytical prediction. This phase consists of the development of analytical techniques to predict the performance and acoustic characteristics of the various tail/rotor configurations under consideration. The prediction programs will then be used to select the final test configurations. Phase II - Experimental verification. This phase consists of the experimental verification of predicted performance and acoustic characteristics utilizing the propeller acoustics static test facility.

Static performance and near-field acoustic data will be acquired for representative configurations. Phase III - Correlation this phase consists of a comparison of the results acquired during Phases I and II, modification of the prediction methods developed during Phase I where necessary and development of design procedures for reducing propeller and rotor noise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0013, COMPOSITE STRUCTURES FABRICATION AND TEST

R.T. Achard, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144640)

This work unit is supportive to preliminary design and evaluation of advanced structural composite materials and basic material processing techniques, and is to include activities related to construction and testing of standard specimens and representative structural geometries using advanced composite materials. The capability to explore technology under parallel investigation by civilian industry, on a much reduced scale, leads to a more thorough understanding and to some degree allows anticipation of problems related to technology development for Air Force aircraft structures application. The objectives of this effort are to perform in-house fabrication and assessment of payoff potential, through inspection and test, of composite structural concepts, arrangements, and geometries including bonded assemblies and hybrid assemblies where applicable. The in-house approach allows for direct dollar savings as well as indirect savings associated with more timely responses to current problems. Timely responses based on thorough understanding permits a more time- and cost-effective approach to the solution of problems inherent in advanced structural design and development.

Efforts within this work unit will include but not be limited to the following - process improvements, tooling development (including investigation of ceramic and composite tools, and use of styrofoam for elastomeric tool molds), fabrication of 3-dimensional composite structures (hat sections, angles, etc.), use of chopped composite materials as filler-reinforcement, stitching of T sections, investigation and improvement of test methods, creation and maintenance of displays illustrative of composites applications in airframes, and conducting of tours and presentations explanatory thereof as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, DEVELOP NEW TECHNOLOGY CONCEPTS FOR AERODYNAMIC GROUND TESTING

M.R. Cain, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141810)

In the development of advanced tactical and transport aircraft and weapons systems, the behavior of the vehicles must be studied throughout the full flow spectrum from the subsonic through the transonic to the hypersonic regimes. The object of this effort is to ensure an in-house capability for aerodynamic and aerothermodynamic studies in the full range of flight by developing new ground test facilities and concepts. The new concepts and developments will have an impact on the development of future aircraft and weapon systems by providing new tools for the study of flow phenomena.

Analytical studies will be made of requirements for an advanced transonic wind tunnel and a trisonic smoke tunnel. Prototype facilities will be constructed to prove the concepts for the advanced transonic test section and a water tunnel for flow visualization work. New flow visualization facilities, water and smoke, will be built for testing. other concepts for testing will be investigated and built as the need is revealed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, OPTIMAL DATA PROCESSING AND FAILURE DETECTION FOR AUTOMATIC FLIGHT CONTROL OF ADVANCED USAF AIRCRAFT

A.P. Dethomas, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF128400)

A high degree of reliability in control data instrumentation is vital to the mission of USAF aircraft, and this objective is typically accomplished by comparing the outputs of redundant system components. However, the penalty in weight and volume of such equipment redundancy can be substantial. Data systems already onboard an aircraft provide functionally related data and this form of redundancy can be exploited rather than resorting to duplication of entire data systems. The objective of this work is to develop practical Kalman filters to combine the information of individual data systems and to use these filters to detect component failures and to replace failed signals, thereby providing failure tolerance.

Beginning with the ABRES vehicles, recognizable future Air Force flight vehicles will be studied and analyzed to identify particular structural areas and components which need and/or may benefit from efficient application of beryllium. Hybrid configurations as well as all beryllium construction will be considered to insure practical consideration of efficient/economical applications of this specialty material. The results of such investigations will be used to provide guidance in the selection of hardware demonstration components necessary to exhibit structural concept feasibility, close technical gaps and establish confidence in the structural adequacy of beryllium.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, TURBULENT FLOW RESEARCH

J.H. Lee, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143170)

Turbulence is an unsolved problem in fluid mechanics, yet one confronts it in many types of aerodynamic work. For this reason, a long-range research program has been instituted to understand the basic mechanics of turbulence and thereby developing new techniques that can be implemented to effectively solve the engineering type of shear flows such as turbulent jets and boundary-layer flows. A particular emphasis is placed on the aerodynamic/structural interaction problems in which the turbulent fluid motion brings about random excitation to part of the aircraft structure or the entire aircraft, thereby affecting the flight dynamics.

The rigorous treatment of turbulence involves analysis of the Navier-Stokes equations using statistical mechanics, random process techniques, stochastic simulation, and model approaches of constructing dynamic equations which share certain features of the Navier-Stokes equations. Probabilistic techniques are used to deal with the structural response excited by random aerodynamic fields. Important parameters are the statistical mean and variance, and power spectral density of the random variables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, ADVANCED DIGITAL CONTROL TECHNIQUES

J.W. McDowell, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140210)

The transport advanced control synthesis program will investigate applications of modern control techniques to aircraft flight control systems. The objective of this effort is the derivation and implementation of improved flight control laws via restructurable digital systems, thus providing the opportunity for enhanced pilot/crew management of aircraft guidance, navigation and control systems. Performance improvements will be demonstrated which can be applied to military missions of cargo/weapon delivery and aircraft rendezvous. In addition, applied modern control techniques offer the capability for minimization of the effects of atmospheric disturbances, such as wind shear.

Design, fabricate, and flight test validate a digital flight guidance system. Develop the in-house capability to restructure

the software and implement flight control laws based upon modern control techniques. Collect flight test data comparing performance of the new control laws. Define applications to future aircraft flight control systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, CREW STATION DESIGN FACILITY FEASIBILITY STUDY

J.A. Uphaus, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136150)

Research requirements have been generated in recent AF Flight Dynamics Laboratory contracts to define display legibility and crew station control/display problem areas. It is apparent that a considerable amount of additional effort must be expended to provide better control/display design criteria for AF fighter aircraft cockpits and thus to provide significant increases in safety and mission effectiveness during military operational flying. A test facility capable of simulating the broad range of extreme illuminance conditions experienced in air-to-air combat, air-to-ground weapons delivery, and other high workload tasks is required to successfully design and evaluate advanced integrated crew stations composed of multi-purpose displays and multi-function controls. This facility would also be utilized by crew station design teams to correct display deficiencies in advance of production and thereby guarantee mission performance and lower life cycle costs for display systems.

During the initial phase of the investigation selected non-axisymmetric exhaust nozzles will be designed, fabricated and statically tested to determine their relative static performance. These nozzles will then be installed in an isolated pod/wing arrangement and tested in a wind tunnel to determine their relative thrust minus drag performance and lift enhancement plus vectoring/reversal capability. The acquired data will then be used to estimate the performance (including maneuver capability) of aircraft that have the non-axisymmetric nozzles installed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, RESEARCH IN PROPULSION

C.L. Walker, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Propulsion Lab., *21000 Brookpark Rd., M/S 77-5, Cleveland, Ohio* 44135 (DA0E3533)

In joint participation with NASA-Lewis Research Center, conduct a fundamental and exploratory program of basic research to provide a technological base in the general areas of small turbine engines and helicopter drive-train systems. Topics also include advanced materials as well as design and analysis techniques.

Specific areas of study are selected on the basis of a continual review of the Army's aviation objective and assessment of those fundamental technological difficiences which prevent or impede achievement of the objectives. The technology base is continually expanded through research effort for engine and drive-train components, including materials, processes and heat tranfer. Consideration is also given for understanding ways to adopt technology from larger engines to use in small sizes applicable to Army aviation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Propulsion Lab.

1.0020, ADVANCED INTERNAL CARGO SYSTEM FOR UTILITY AND CARGO HELICOPTERS-CONCEPT DEMONSTRATION & EVALUATION.

R. Campbell, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G0935; DAAK51-80-C-0006)

To identify, select and evaluate candidate advanced technology components for a helicopter internal cargo handling system which meets established criteria and to design, fabricate and test hardware for flight evaluation using the CH-47 as the demonstration vehicle.

The contractor will accomplish this objective in three tasks; technology identification, analysis and preliminary design and test plan and fabrication, assembly and test. The total contract is scheduled to be 17 1/2 months.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0021, INVESTIGATION OF THE CRASH IMPACT CHARACTERISTICS OF HELICOPTER COMPOSITE STRUCTURES

J. Cronkhite, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0G0418; DAAK51-79-C-0037)

A. To investigate the crashworthiness of composite helicopter airframe structures in comparison to similar metal structures, b. To develop design, test, and analytical procedures for crashworthy composite helicopter airframe structures.

During Task I, a review of work-in-progress, preliminary designs of crashworthy composite fuselage structures, and design support testing will be performed. During Task II, the contractor will perform the analytical, crash impact testing data analysis, and correlation effort required by the Task II test plan.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0022, FAULT-TOLERANT ACTUATION CONCEPT FOR THE NAVTOLAND TEST AIRCRAFT

M.R. Murphy, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DN081444; N62269-79-C-0292)

To develop a fault-tolerant, dual-fail operational flight control actuation concept for the NAVTOLAND test aircraft. This contract supports W.U. ZA601, agency accession no. 681080.

Design, fabriacate, test, and demonstrate a four-valve, dual-tandem actuation concept that will provide dual-fail operational capability.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0023, DURABILITY METHODS DEVELOPMENT

S.D. Manning, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF140660; F33615-77-C-3123)

Current Air Force structural integrity policy requires that an Air Force airframe shall be designed such that the economic life is greater than the design service life when subjected to the design service loads/environment spectra. This is necessary to minimize cracking or other structural or material degradation which could result in excessive maintenance or functional problems. Compliance with this policy requires the ability to predict the economic life of an airframe. The objective of this program is to develop and verify the durability methodology necessary to predict the economic life of advanced structures. The results will be used to design more durable military aircraft structures.

Durability methods shall be developed based on a crack growth damage accumulation approach using an equivalent initial quality concept and a statistical approach employing a reliability-based model. The most promising of these methods will be evaluated and verified using quantitative structural cracking data obtained from high-time service structures or full-scale test articles. The results will be documented in the form of a durability design handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, PROPULSIVE-LIFT POWERED RESEARCH MODEL TESTS

P.D. Whitten, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF142540; F33615-78-C-3032)

Recent wind tunnel tests and studies have indicated that significant STOL and maneuver performance benefits are possible as a result of propulsive aerodynamic concept application for advanced tactical aircraft. In particular, the combination of both spanwise blowing and upper surface blowing, e.g. the vectored engine-over-wing (VEO-wing) concept has been shown to provide improvements over the entire angle of attack range at

subsonic and transonic speeds. Unpowered configuration model tests have indicated that viable design arrangements, which do not degrade performance, are possible; however, the powered data base is somewhat deficient. The objective of this effort is to expand the powered data base by experimentally investigating engine nacelle location, nozzle arrangements and control surface variations applicable to realistic advanced tactical aircraft configurations. Results will be available for assessment of the STOL and maneuver performance of air-to-surface and air-to-air fighters.

Testing will be conducted in the NASA/LARC 16-foot transonic and V/STOL wind tunnels using a contractor-owned powered research model. Longitudinal aerodynamic/stability and control data will be obtained over the angle of attack range of minus 4 to 40 degrees and at Mach numbers from low speed to 1.2. Variations in nacelle location, nozzle arrangement and control surface deflections will be investigated at typical fighter aircraft engine operating conditions. The experimental data will be analyzed to verify the propulsion/aerodynamic benefits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, STRUCTURES TECHNOLOGY
J.L. Shipley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Research & Technology Lab., *Hampton, Virginia* 23665 (DA0E3552)

To investigate helicopter rotor aeroelastic effects, resulting dynamic loading and vibration, maneuvering loads, and then develop analytical techniques for predicting these effects in existing and future Army aircraft. This technology is necessary to preclude the occurrence of these instabilities in flight regimes required of rotorcraft to enhance the safety, survivability, and mission effectiveness. In addition, design criteria will be developed and concepts tested which enhance rotorcraft capability without incurring dynamic limitations.

Research in rotor aeroelasticity analytical efforts will include coupling of the root perturbation method (RPM) computer code with an existing aeroelastic analysis. Major emphasis in this technical area will be to implement plans to enhance the capability for predicting helicopter vibrations and the development of techniques for reducing these vibration levels. Control system logic will be designed for the TDT model and closed loop tests of a four-bladed system will be conducted. The program to develop a coupled rotor fuselage structural analysis will be continued. Evaluation of vibration-reduction devices will concentrate on completing the state-of-the-art review and the generation of math models of vibration-reduction devices.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0026, DESIGN MANUAL FOR DAMAGE TOLERANT COMPOSITE STRUCTURES
J.G. Avery, Boeing Co., Boeing Aerospace Company, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN890252; N00019-80-C-0048)

Develop a design manual for damage-tolerant composite structures presenting verified design approaches for achieving combat survivability in fiber composite aircraft structures.

Based on evaluation of available ballistic damage and structural response data, analysis method will be described for prediction of damage extent and residual strength of composite structures. Design applications will analyze use of various crack arresting methods and include trade studies comparing structural weight penalties for damage-tolerant designs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0027, NON-AXISYMMETRIC NOZZLE/AFTBODY FLOW FIELD ANALYSIS
K.M. Peery, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF143720; F33615-79-C-3018)

The Air Force function for this effort is to improve present numerical methods used for pressure drag calculation of non-axisymmetric nozzle boattail configurations. The problem is that experiemental testing of aircraft configurations in wind tunnels is becoming increasingly expensive. The objective of this effort is to devise a method, using the Navier-Stokes equations, capable of predicting flow conditions in the near region of a non-axisymmetric nozzle boattail configuration. This type of analysis will demonstrate that a solution for the above mentioned case can be computed which has the accuracy of wind tunnel data, but will result in a significant cost savings to the Air Force.

The approach will model the internal and external flowfields, which will be input upstream of the exit, near the nozzle. The analysis encompasses the ramp and the lower surface of the cowl with the upper surface cowl solution being 'patched' into the lower region solution. By using this method, good definition of the flowfield and plume boundary should be achieved. Turbulent flow will be assumed over the entire region because of the jet temperature range being analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, FLYING QUALITIES OF AUGMENTED AIRCRAFT
J.M. Schuler, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139220; F33615-78-C-3603)

This work unit supports the flying qualities specification MIL-F-8785B. The problem is to identify areas in MIL-F-8785B that can be revised to increase the safety assurance aspects of flying qualities requirements. The objectives are - (1) improvement of interfacing between MIL-F-8785B and the flight control system specification MIL-F-9490D, (2) development of criteria for highly augmented unstable or neutrally stable aircraft under normal and emergency conditions, (3) improvement of criteria concerning pilot-induced oscillations, (4) development of criteria for control saturation and pilot workload saturation conditions and (5) development of criteria covering unusual or extreme atmospheric environmental conditions. The results will be used to make future military aircraft safer through improving the handling qualities specification MIL-F-8785B.

The approach to achieve this objective includes reviewing existing requirements and conducting analytical investigations to develop criteria for the problem areas identified in the objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SOLAR PHOTOVOLTAIC CONVERTORS BASED ON CADMIUM-TELLURIDE PREPARED BY HOT-WALL FLASH EVAPORATION
R.H. Bube, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (INT79-06574)

The collaboration on this project brings together Dr. Richard Bube and associate Dr. Alan Fahrenbruch of Stanford University, working jointly with Professor Feliciano Sanchez-Sinencio and associates of the Center for Research & Advanced Studies of the Polytechnic Institute of Mexico. The research is being directed primarily to the preparation, properties and characterization of 'p-type' cadmium telluride large-area thin films and to the formation of junction devices involving these thin films. Fundamental studies in this area have application to photovoltaic conversion of solar energy.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0002, HIGH TEMPERATURE OXIDATION/CORROSION MATERIALS
D.P. Whittle, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (005923 TICNO; 4064)

The task involves determination of the effects of metallurgical and environmental variables on the surface degradation of materials in aggressive atmospheres and the influence of sulfatic deposits, mechanisms of degradation and the relation to diffusional, structural and compositional parameters of the oxides, sulfides and carbides involved. The effect of gas flow rate and detailed gas composition on corrosion behavior is included. The modification of oxide defects by the incorporation of sulfur and interactive diffusion in alloy scales are studied. Development of resistant materials and coatings includes active element and dispersed stable phase additions to promote alloy/scale adhesion by modification to the alloy/scale interface and the nature of the alloy/scale interface. Multicomponent diffusion in coating/alloy substrate systems and quantitative relationships to the fundamental thermodynamic and transport properties involved are studied.

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SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0003, MICROWAVE SPECTROSCOPY OF BORON HYDRIDES, CARBORANES, AND SHORT LIVED INORGANIC SPECIES

R.A. Beaudet, University of Southern California, School of Letters Arts & Sciences, Dept. of Chemistry, *3551 University Ave., Los Angeles, California* 90007 (CHE80-12116)

Dr. Beaudet is supported by a grant in the Structural Chemistry and Thermodynamics Program to carry out detailed structural measurements on specific carbon, and boron containing molecules. Carboranes and boron hydrides are compounds of great interest because of their potential applications for high vacuum and high temperature polymers. In addition, these compounds have also found use as catalysts in the formation of rubbers and elastomers, and as modifiers in propellants for small rockets. Beaudet will complete the structure of 1-methyldiborane and the rotational analysis of 1,2-dimethyldiborane will be finalized. Studies will also be initiated on a series of short-lived silicon containing molecules in an effort to characterize more accurately examples of silicon-silicon, silicon-carbon and silicon-oxygen double bonds. This work is a continuation of Foundation grant CHE 7701578.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, INVESTIGATION OF COOPERATIVE AND DYNAMIC PHENOMENA IN MOLECULAR SOLIDS

E.R. Bernstein, Colorado State University, School of Natural Sciences, Dept. of Chemistry, *Fort Collins, Colorado* 80523 (DF048720; AFOSR-77-3317)

AF function - future Air Force weapons and avionics systems will require low cost, high purity electromagnetic materials with unique electronic and electro-optical properties. Deficiency - the molecular crystal chemistry which is essential for predicting electromagnetic materials' properties has not been established. Objective - the object of this research is to develop the characterization and understanding of cooperative solid-state phenomena in organic and inorganic molecular crystals. How work contributes - it is expected that this research will contribute to the development of new methods in crystal chemistry for predicting new organic and inorganic chemical structures with ferroelectric electrooptical and solid-state electronic and magnetic properties.

Light scattering experiments from molecular crystals will be conducted to identify and relate soft modes, lattice instabilities and structural, magnetic and electrical phase transitions. Brillouin intra-and intermolecular Raman scattering and angle-dependent polariton raman scattering will be conducted on symtriazine, sym-trioxane, silicon and germanium tetrafluorides, and rhenium and iridium hexafluorides to generate a more complete understanding of elementary excitations of molecular solids in the vicinity of phase transitions. In particular, the rhenium and iridium hexafluorides, the only magnetically ordered molecular crystals known, will be studied in the magnon-phonon region above and below the magnetic-ordering temperature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, SEMICONDUCTOR MATERIALS

H. Lessoff, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880010)

To purify starting materials, to develop processing technology and to grow bulk single crystals and epitaxial layers of semiconducting materials including those from groups IV, II-VI, and III-V needed by the Navy for solid-state electronic and electro-optic devices.

Single crystals of such materials are gallium arsenide, indium phosphide GaInAsP, are grown by a variety of techniques including liquid-encapsulated Czochralski, liquid- and vapor-phase epitaxy. Various technologies are used for purification and compounding including high-pressure reaction, zone melting, and vacuum transport. Novel techniques are continuously being sought to reduce the background impurity levels, to increase crystal perfection and to develop new compounds having desirable optical, and semiconducting properties for Navy needs at the microwave, millimeter wave and optic wave lengths. New material combinations are being prepared for potential useful applicatins.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0006, APPLICATIONS OF SEMICONDUCTOR MATERIALS

W.J. Moore, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620099)

To obtain basic knowledge of the electrical and optical properties of semiconductor materials which limit the performance of solid-state devices of interest to the Navy. Of particular interest are materials which have application as active microwave devices or as infrared detectors including both elemental and compound semiconductors.

Electrical and optical properties of selected materials are determined by using measurements such as optical and magnetooptical spectroscopy, photoconductivity, transient capacitance spectroscopy, Hall effect and noise studies. Such measurements are carried out on specially prepared bulk material and epitaxial layers produced in-house, on MIS structures, and on commerical devices such as prototype infrared detectors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0007, PROPERTIES OF THERMOSTRUCTURAL MATERIALS

P. Shahinian, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680087)

Develop knowledge of the metallurgical and mechanical behavior of thermostructural alloys under conditions representing high temperature naval applications, particularly propulsion systems and power plants, such as gas turbines. Understand influence of metallurgical and external factors contributing to high temperature behavior including crack extension, creep resistance, and environmental compatibility of these alloys. Provide guides for specification of improved materials and engineering reliability criteria.

Thermostructural alloys will be exposed to simulated high temperature environmental conditions representative of typical service. Experimental techniques will be developed and applied to assess metallurgical properties including the combined effects of creep and fatigue in the presence of notches. Properties as-

sessments will be projected to define or predict structural behavior.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0008, ADVANCED COMPOSITE MATERIALS
R.Y. Ting, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN080090)

Develop bisphenol-linked phthalocyanine resins as the matrix material for high-performance structural composites for advanced Navy aircraft.

Provide an in-depth evaluation of the chemical, physical and mechanical properties of bisphenol-linked phthalocyanines, select an optimized formulation for extended B-staging and cure studies relevant to composites fabrication, develop procedures for fabrication of composite structures, and provide quality assurance methodology for resin, prepreg and composite materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0009, MATERIALS RESEARCH WITH UV AND X-RAYS
R.T. Williams, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN780145)

To characterize the linear optical properties of wide-band-gap materials, to determine response of these materials to laser and particle radiations, and to identify fundamental physical phenomena responsible for optical attenuation. This work will lead to new and improved materials for optical components, lasers, radiation detectors, photolithography and UV technology.

Synchrotron radiation from the SURF II storage ring at NBS will be used to characterize the optical and electronic properties of various optical materials, primarily oxides and halides, in the 10-100 eV range. Nonlinear optical response will also be investigated using a combination of sources. Pulsed lasers will be used to probe the internal photoionization processes which lead to laser-induced breakdown. Photochemical processes in transparent materials will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0010, HIGH TEMEPRATURE MOLECULES AND MOLECULAR ENERGY STORAGE
W. Weltner, State University System of Florida, University of Florida, College of Liberal Arts & Sciences, Dept. of Chemistry, *208 Tigert Hall, Gainesville, Florida* 32601 (DF042010; AFOSR-76-2906)

AF function - rocket propulsion, electromagnetic weaponry. Deficiency - structural and spectroscopic information on molecular species found in high temperature systems such as wakes, plumes, nozzles, lasers and combustors is required for improved design features of Air Force systems. Objective - research includes optical and electron spin resonance (ESR) spectroscopy of molecular species and the spin-alignment of radicals at high magnetic fields and low temperatures. How work contributes - the optical and ESR spectra of high temperature species provides information of vibrational, electronic and magnetic energy levels which is useful in plume identification and suppression and in the development of advanced lasers. Spin-aligned radicals provide a potentially important source of advanced, high energy propellants.

Species are vaporized and trapped in solid argon matrices at 4-10 degrees K for the study of their optical and ESR spectra. Species to be examined include carbon molecules (C5, C6) silicon species (SiC, SiN, SiO2), the oxides, hydrides, fluorides and nitrides of the transition metals Mn, V, Fe, Cr, Ni and Yb, and Hf2 and HC12. A molecular energy storage apparatus has been constructed to allow spin alignment of radicals at high magnetic fields and low temperatures and will be tested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, ELECTRONIC STRUCTURE CALCULATIONS EMPLOYING PSEUDOPOTENTIALS (THEORETICAL DEVELOPMENTS AND APPLICATIONS TO SILICON CHEMISTRY)
M.A. Ratner, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Chemistry, *633 Clark St., Evanston, Illinois* 60201 (CHE78-12234)

This grant supports research under the Quantum Chemistry Program for theoretical studies of valence-electron properties of linear and cyclic oligosilanes. Although silicon is isoelectronic with carbon, its compounds show substantial differences and whose experimental characterization is still in progress and whose theoretical understanding is not far beyond the qualitative discussion stage.

Dr. Ratner will extend three existing theoretical methods to include model potentials for core electrons so that the chemistry of these silicon compounds can be investigated theoretically. Only in this way can questions concerning electron delocalization, hydrophobic bonding, and nucleation be addressed. These developments would also permit a direct probe of metal-Si complex chemistry and regional bonding features such as charge transfer and oxidative addition.

In addition to these general structural questions, one unique feature of the project will be a calculation of the frequency-dependent conductivity using local density methods. This is perhaps the most direct measure of electron delocalization which is a central issue in polysilane chemistry.

This is a renewal of support for research under NSF Grant CHE7417434 at Northwestern University.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, PHYSICAL PROPERTIES - BASIC CERAMICS STUDIES
N.L. Peterson, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (005306 TICNO; 58303)

The program described in this Field Task Proposal is concerned with fundamental research, both theoretical and experimental, on phenomena that occur primarily in ceramic solids; phenomena of particular relevance to the eventual use of ceramics at elevated temperatures in energy generation and storage systems have been emphasized. The problems under study include: (1) defect concentrations, defect mobilities, impurity-defect interactions, and defect clustering in off-stoichiometric and highly defective oxides; (2) the structure and properties of grain boundaries in oxides; (3) x-ray and neutron-scattering studies of defect configurations in oxides; and (4) mechanisms of diffusion and electrical conductivity in glasses.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0013, STATISTICAL DYNAMICS AND GAS/SOLID PROCESSES
S.A. Adelman, Purdue University, School of Science, Dept. of Chemistry, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR76-81113)

The goal of this research is to apply and further develop the principal investigator's generalized Langevin methods for classical and quantum statistical dynamical calculations of gas/solid surface processes. The new methods allow one to treat the many-body problem in gas/solid dynamics in a computationally simple manner. This is of importance in surface chemistry and physics since many-body influence must be included in any qualitatively correct dynamical theory of surface diffusion, desorption, and reaction.

The approach is based on a separation of the solid into a primary region which interacts strongly with the gas atom and a secondary region which comprises the remainder of the lattice, and which functions as a heatbath. The key idea is that the motion of the heatbath need not be explicitly followed since only the influence of this motion on the collision is observable. This influence depends on only rather gross features of the heatbath's complex dynamics and may be accurately modelled. With heatbath modelling, the original set of many-body dynamical

equations of motion may be reduced to a computationally tractable set of few-body equations of motion. These equations, for the classical case, may be solved by standard classical trajectory methods.

Scattering, trapping, desorption, diffusion, and reaction will be studied using the classical version of the new methods. Further development of the quantum theory is planned. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0014, SOURCES, TRANSFORMATION, AND CHEMICAL NATURE OF ATMOSPHERIC POLLUTANTS

G.E. Gordon, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Chemistry, *College Park, Maryland* 20742 (PFR7502667A06)

This is a continuation of work under Grant ENV75-02667 A05 on the trace elements in size-graded particulates emitted by power plants, refuse and sludge incinerators, automotive traffic, airports, copper smelters, steel mills, and cement plants. The objective is to identify the sources of toxic elements in the atmosphere and to measure the relative contributions of natural and individual man-made sources to be particulates of urban atmospheres.

This grant extends the study to a more complete characterization of copper smelters, a cement plant, and a steel mill, and to the aircraft sampling of two or three other non-ferrous smelters (zinc, lead, or nickel). This extension will add size-graded particulate analyses of the copper smelter plumes (and of the other smelters), it will expand the list of elements to be measured, determine solubilities of toxic elements in the particulates, and provide analyses of in-plant materials to determine the role of fractionation processes governing the composition of the stack emissions. The resulting expanded data base will be used to refine the existing model for estimating source contributions to urban air particulates.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Problem Focused Research

3.0015, MATERIALS SUPPORT TECHNOLOGY - SYNTHESIS OF HIGH TRANSITION TEMPERATURE A15 SUPERCONDUCTORS BY MEANS OF ION IMPLANTATION

R.M. Rose, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN675156; N00014-76-C-0297)

The objective is to characterize the composition and study the properties of high transition temperature A15 superconducting materials which are prepared by means of ion implantation. These materials are of direct interest to the Navy in superconduction devices for use in its communications, data processing and ASW systems.

Substrates of Nb-Al-Si are being prepared, characterized and implanted with Si ions at various dosages and energies. The composition, depth, thickness and crystalline order of the implanted layers are being characterized by means of x-ray diffraction and electron microscopy. Specimens are being annealed under various conditions and studied for evidence of epitaxial growth and/or substitution. Measurements of transition temperature and other superconducting properties are being made as a function of implantation temperature and initial specimen preparation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0016, ELECTRONIC CONDUCTION IN SOLID OXIDE ELECTROLYTES

H.L. Tuller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (004928 TICNO; 88203)

Electronic conduction has an important bearing on the operating characteristics of solid oxide electrolytes. In order to learn more about the mechanisms which control electronic charge generation and transport in thoria electrolytes, studies of the effects of composition, temperature, atmosphere, and other variables on their electrical properties are being performed. Electrical conductivity and ionic transference measurements performed as a function of both temperature, oxygen partial pressure, and dopant concentration on a series of ceria-doped thoria solid solutions are reported. These results are analyzed in terms of defect chemistry. Progress in the development and use of a cross-correlation technique for measuring complex impedance is also reviewed. An advanced cross-correlator apparatus has been completed and tested. Preliminary complex impedance measurements performed on calcia-and Yttria-stabilized zirconia show grain boundaries control the impedance to elevated temperatures. Electrical conductivity measurements on ceria-doped thoria electrolytes have been extended to high dopant levels. Results have been analyzed in terms of defect chemistry.

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SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

3.0017, COATINGS FOR UPGRADED PERFORMANCE OF GAS TURBINE ALLOYS

J.J. Falco, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0B4762)

To develop improved high temperature coatings for nickel-base superalloys and columbium alloys for application in the compressor and hot turbine section of gas turbine engines in order to upgrade performance through higher turbine inlet temperatures and increases in time-between-overhaul. Coatings to be developed include - a) sulfidation resistant coatings for superalloys (e.g., airfoils) and b) oxidation-sulfidation resistant coatings for columbium alloys (e.g., blades and vanes).

Oxidation and sulfidation resistant McRaly coatings for superalloys will be further developed utilizing less costly electrophoresis and plasma spraying plus diffusion treatments. Thermal barrier overlays ZrO2/Y2O3 will be employed to decrease substrate temperature. Graded compositions of McRaly and ZrO2/Y2O3 will be used as intermediate layers to mitigate thermal cracking. Coating parameters will be optimized to produce minimum substrate embrittlement by controlled diffusion. Performance in the dynamic hot-corrosion test rig will be compared to current overlay coatings.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0018, SUPERVISION OF METAL MATRIX CONTRACTS

A.P. Levitt, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G2376)

The technical objective is to provide technical supervision of contracts dealing with the research, development, and evaluation of metal matrix composites for helicopter-drive systems and bridging. Composite systems under study include FP/aluminum, graphite/magnesium, graphite/aluminum, silicon carbide/aluminum, and boron/aluminum.

Provide technical supervision over these contracts to assure that they are competently and effectively carried out. Related in-house efforts will be conducted to assure that the technical supervisors keep abreast of the new developments in this fast growing field.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0019, DEVELOPMENT OF ADVANCED CERAMIC RADOME MATERIALS
F. Meyer, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4702)

Materials for advanced hypersonic missile RADOMES are required for velocity regimes beyond the capacity of slip cast fused silica. The careful addition of high purity fused silica fibers to the basic fused silica slip should result in a RADOME structure of higher mechanical strength (and erosion resistance) and equivalent dielectric properties. This program will optimize slip casting and sintering techniques to fabricate high purity fiber reinforced slip cast fused silica. Pacing problem - RADOME materials to Mach 6 - thrust - hypervelocity weapons.

Two separate approaches will be undertaken to develop fiber reinforced fused silica RADOME structures. (1) The principal effort will be devoted to developing a technique for dispersing chopped fused silica fibers in a fused silica slip. A commercial model high speed Waring blender will be used to chop high purity fused silica fibers to various lengths and then systematically add the fibers to high purity fused silica slip for the casting of prototype RADOME structures. This process will allow various fiber contents to be used with the fibers being of known length and upon slip casting the fibers will be randomly oriented. (2) A second approach will use continuous roving of high purity fused silica which will be coated with a silicone resin and wound onto a RADOME-shaped mandrel. The resin used for this process is one that will convert to a high purity amorphous silica upon firing. This filament winding technique will produce RADOME structures of varying fiber content with the fibers being completely oriented. Several different wrapping techniques will be used to determine the optimum procedure. RADOME structures fabricated from both approaches will be tested and evaluated to determine the effects of the fibers on physical, mechanical and dielectric properties.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0020, DEVELOPMENT OF IMPROVED ARMORS FOR GROUND VEHICLES AND AIRCRAFT
J.J. Prifti, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0E4808; N/A)

To develop cost-effective armor systems and enhance existing armors by utilizing combinations of conventional and state-of-the-art materials to achieve optimal systems for (a) defeating AP projectiles and fragmentation munitions, and (b) containing armor-backed spall and/or reducing behind-the-armor fragments when attacked by heat- and other high-energy-penetrating weapons. Specifically armored aircrew seats (AAH, UTTAS, AIO) and advanced lightweight vehicle armor (IFV) will be addressed.

Advanced armor systems will employ both conventional (High Hard, RHA) and new steels (ESR 4340, 4350, Dual Hard) and aluminums (5083, 7039) with high efficiency fragmentation-protective armor materials including Kevlar 29/49, XP film, and glass-reinforced plastics. Improved protection and/or reduced armor weight will be established in terms of v sub 50 limits, and for optimal systems by behind-the-armor characterization (fragment number, MA-S, velocity, and dispersion).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0021, RECYCLING EXISTING PAVEMENT MATERIALS FOR PAVEMENT REHABILITATION
E.R. Brown, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0Z8026)

Current construction state-of-the-art includes recycling processes for asphalt pavements. Recycling asphalt pavement can provide economic, logistic, environmental, and technical benefits. However, there is a lack of definitive criteria that would take advantage of functional properties of the recycled material. It is proposed that a study be initiated to develop design and construction criteria for recycling asphalt concrete. This objective would best be accomplished by a laboratory study of pertinent material and mechanical properties. Test data from this study would form a data base from which to generate criteria and means of evaluating the capability and performance of recycled asphalt paving materials.

The intent of this study is to develop criteria for reuse of existing asphalt/concrete airfield pavements. The study will encompass a review of procedures for breaking up and reusing embrittled asphalt, laboratory tests on recycled mixtures, establishment of quality provisions for recycled mixtures, and preparation of a technical report containing criteria recommendations.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

3.0022, EFFECT OF MOLECULAR STRUCTURE ON MESOMORPHIC BEHAVIOR
A.C. Griffin, University of Southern Mississippi, School of Science & Technology, Dept. of Chemistry, *Hattiesburg, Mississippi* 39401 (DMR78-05284)

Liquid crystals can flow like liquids, but have some of the molecular ordering of solids. The changes of this ordering and of the optical properties with temperature or applied field are the basis of using liquid crystals in, say, the familiar digital thermometers or display devices. The goal of Professor Griffin's work is to examine how the tendency of the liquid crystal phases to undergo transitions is affected by such chemical attributes of the constituent molecules as dipole interactions, polarity, size, and ability to hydrogen bond. The long-range goal of this work is to enable the synthetic chemist to tailor-make a system with desired transition temperature and optical properties. A correlation between molecular structure (electronic and steric factors) and smectic properties is to be established by preparing and examining binary mesophase systems. New smectic materials are synthesized as required. Experimental studies include (1) microscopic measurements of transition temperatures and phase identification; (2) thermal measurements of heats and temperatures of transition for selected pure compounds and binary systems using differential scanning calorimetry; (3) X-ray studies of structure when required by the uniqueness of the binary behavior.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0023, RARE EARTH ADDITIONS TO TITANIUM ALLOYS
S.M. Sastry, McDonnell Douglas Corp., McDonnell Douglas Research Laboratory, *P.O. Box 516, St. Louis, Missouri* 63166 (DN675493; N00014-76-C-0626)

Titanium alloys are important lightweight structural materials for use in aircraft and ships. Alloy microstructure and mechanical properties can be controlled by effective use of alloying and processing. This research will explore the effects of rare-earth additions to titanium alloys.

The influence of yttrium additions on the superplasticity of titanium alloys Ti-6Al-4V and Ti-62ll will be determined. The strain rate, time- and strain-dependencies of flow stress at 850-925OC will be determined in these alloys with yttrium added up to .0035 weight percent or yttrium oxide to 0.01 weight percent. Grain refinement and texture will be measured.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0024, SELECTIVE STUDIES ON DEPHASING OF OPTICAL EXCITATIONS IN MOLECULAR AGGREGATES
P.N. Prasad, State University of New York, Buffalo Campus, School of Natural Sciences & Mathematics, Dept. of Chemistry, *3435 Main St., Buffalo, New York* 14214 (DMR78-20733)

With recent advances in high-power, tunable lasers, spectroscopy has added a new dimension: coherent spectroscopy,

where excitations in a solid are created in a definite phase relationship with one another. In order that coherent spectroscopy can be used for studies of superradiance or of various nonlinear optical effects, it is important to understand processes which destroy this phase relationship. These processes, called dephasing, have been investigated by many workers, and several mechanisms have been proposed. The present understanding of dephasing, however, is far from complete. The purpose of the present work is to investigate experimentally the process of dephasing for phonons and for electronic excitations in organic solids, such as 1-bromo-4-chloronaphthalene. Laser Raman spectroscopy and electronic spectroscopy are used. Temperature dependences of line frequency, line shape, and line width for phonons and electronic transitions are measured. Results will be compared to predictions of various models.

This is a continuation of work supported by DMR75-02628.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0025, MOLECULAR BEAM EPITAXIAL GROWTH OF MERCURY CADMIUM TELLURIDE

K.L. Moazed, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Metallurgical Engineering, *Raleigh, North Carolina* 27607 (DF053630; AFOSR-78-3721)

AF function - secure space communication and surveillance and covert optical electronics require devices which exploit the properties and interaction effects of materials with far-infrared radiation. Opportunity - infrared materials research has a high-potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - more specifically, the objective of this research is to grow various compositions of (Hg, Cd)Te alloys using molecular beam epitaxial techniques in an all-glass system designed to insure homogeneous composition over the surface of the substrate. The films will be characterized crystallographically, electrically and optically. How work contributes - the ability to grow large, uniform single crystals of fast, sensitive, narrow-gap semiconductors such as (Hg, Cd)Te economically and reliably would advance AF capabilities in infrared detection and electro-optical surveillance.

In designing the all-glass apparatus for crystal growth of (Hg, Cd)Te compounds the major deficiencies of MBE techniques in use currently will be circumvented. These deficiencies are - the relatively low level of vacuum maintained in the system during deposition which affects background contamination, the configuration of the various sources with respect to the substrate and large variations in the source temperature. Suitable precautions are to be made because of the high vapor pressure of mercury and its ability to contaminate nearly everything it contacts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, OXIDATION OF NON-OXIDE CERAMICS

A.H. Heuer, Case Western Reserve University, School of Engineering, Dept. of Metallurgical & Materials Science, *University Cir., Cleveland, Ohio* 44106 (DF051830; F49620-78-C-0053)

AF function - high temperature ceramic turbine engines are being developed for the propulsion of Air Force remotely piloted vehicles (RPV). Deficiency - silicon carbide- and silicon nitride-type ceramics, formed by sintering or hot pressing powders, are subject to high-temperature degradation in the extreme turbine-operating environments. Creep, oxidation and microstructural changes within the ceramic need to be evaluated. Objective - the objective of this research is to study and understand the micro-chemistry and structural events which dictate the observable property changes in nonoxide ceramics. How work contributes -understanding the micro events will allow a rational approach to be taken in the selection of chemical composition and processing technique for improved materials.

A high voltage transmission electron microscope (TEM) equipped with an environmental cell will be used to study in situ chemical reactions. The distribution of phases and microstructure will be determined and correlated with microanalysis of oxide layers in order to provide further clues to the oxidation mechanisms. Theoretical and experimental studies of diffusion will be applied to the oxidation and sintering of covalent compounds. Various transport mechanisms will be examined to assess the validity of these sintering and oxidation models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0027, CONTROLLED STRUCTURE ADHESIVE INTERPHASES

J.B. Lando, Case Western Reserve University, School of Engineering, Dept. of Macromolecular Science, *University Cir., Cleveland, Ohio* 44106 (DF053160; AFOSR-78-3692)

AF function - the AF seeks to improve durability and reliability of composite structures, since these materials offer light weight and reduced manufacturing costs when incorporated into advanced airframe structures. Deficiency - despite many years of intensive study, the nature of the adhesion interphase (in composite materials) and its deterioration by environmental attack, notably by water, has eluded elucidation. The use of adhesion promoters for composite systems consequently has not obtained any firm basis for prediction or optimization. Objective - seek greater understanding of molecular processes involved. How work contributes - to determine adhesion-related properties of monolayers and multilayers of coupling agents formed with known and controlled compositions and structural packing configurations upon well-characterized glass, pyrolytic graphite and resin substrates.

Variations in the composition of the coupling agent and its mixtures and in the technique of layer deposition will be employed to introduce specific layer sequence structures and defect/void regions in the interphase. The interphase will be characterized by electron microscopy, a unique micromechanical tensile test, and other techniques as deemed appropriate to establish the nature and perfection of interphase structures and component interactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0028, HIGH TEMPERATURE HEAT TRANSFER TEST PROGRAM

A.E. Hasue, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460310)

To test, analyze and evaluate hot section components for advanced turbopropulsion applications. Typical applications include evaluation of high temperature turbine vane/blade cooling schemes and testing of advanced materials and coatings. To analyze high gas and material surface temperature measurement concepts.

In the initial facility application, turbine vane cooling concepts are evaluated by mapping thermal contours of the vanes using infrared techniques. A color data pyrometer observes vane temperature while the desired test conditions are varied. Temperature- and pressure-measurement concepts are evaluated during vane tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0029, REACTIONS IN LIQUID CRYSTALLINE PHASES

M.M. Labes, Temple University, School of Liberal Arts, Dept. of Chemistry, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (DMR77-07811)

Reactions in both liquid crystalline and isotropic phases are studied using a technique in which the kinetics are followed quantitatively via the optical changes in an aligned chiral nematic layer. The possibility of a new type of micropolarimetry is explored by studying quantitatively the texture features of solutions of chiral species in aligned mesophases. Attempts will be made to prepare and study the properties of polymer films containing aligned elliptical pores in the micron size range.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0030, POLLUTION CONTROL IN AIRCRAFT MATERIALS
D.R. Agnew, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN581140)

(a) Develop the technology necessary to abate aircraft materials pollution via materials and processes control, design and/or modification. (b) Control the use/disposal of hazardous and toxic materials. (c) Assist NAVMAT in maintaining an effective and integrated research and technology program in support of the Navy E.P.P. (environmental protection program). (d) Develop new packaging techniques for reduction of refuse at sea.

The best concept is to attack pollution problems by initiating material/process changes which eliminate or reduce pollution at the source rather than treatment of wastes. Hazardous/toxic materials used by the Navy will be identified and less hazardous substitutes will be recommended, or control methods will be recommended for the use and disposal of required hazardous materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0031, NAVY VEHICLE DESIGN AND CONSTRUCTION - CONTROLLING SOLIDIFICATION VARIABLES TO DEVELOP DESIRED PROPERTIES IN CAST METAL ALLOYS
H.D. Brody, University of Pittsburgh, School of Engineering, Dept. of Metallurgical & Materials Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (DN823163; N00014-75-C-0800)

Many naval components are used in the as-cast form. Mechanical properties of castings and directionally-solidified composites are directly related to the cast structure and any alloy segregation that occurs during solidification. This research is aimed at improving properties of castings through control of the process variables.

An analytical model of the continuous casting process will be extended to account for grain structure and chemical segregation. High temperature peritectic alloy systems (Ti-Al, for example) will be directionally solidified to produce aligned two-phase and single-phase structures. Properties and potential applications will be evaluated. Segregation in aluminum-copper alloys will be examined to determine effects of grain shape, solidification rate and fluid motion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0032, A STUDY OF LOCALIZED PLASTIC DEFORMATION AS RELATED TO FATIGUE MECHANISMS
R.J. Asaro, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DF047680; AFOSR-77-3246)

AF function - certain high strength structural materials used in aerospace systems (including some aluminum and titanium alloys) are susceptible to the occurrence of strain localization. Opportunity - this phenomenon is due to the development of localized regions which are plastically unstable, and results in severe reductions in fatigue life and ductility. The process is particularly insidious since critical strain for fracture can be locally surpassed at very low average macroscopic strain, thus leading to unexpected premature failure. Objective - this research will - (1) identify the experimental conditions which cause plastic deformation of homogeneous bodies to become localized into intense shear bands, (2) ascertain to what extent these bands cause material damage, crack initiation or contribute to crack growth, and (3) analyze the initiation of plastic localization both as an abrupt degradation or weakening of the material and also as an instability in the constitutive description of plastic flow. How work contributes - this fundamental study will investigate localized plastic deformation, and the role it plays in fatigue mechanisms, metal ductility, and fracture processes.

Experiments will be performed on single crystals and axisymmetric polycrystalline specimens of aluminum-copper alloys in order to precisely document the conditions of stress state, strain rate, work hardening rate, temperature and metallurgical structure which allow localization of plastic flow to occur. Subsequent studies will include 2000 and 7000 - series commercial aluminum alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0033, A FUNDAMENTAL STUDY OF THE MICROWAVE-EXCITED PLASMA
S.R. Goode, University of South Carolina, Graduate School, Dept. of Chemistry, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (CHE78-15436)

Dr. Goode's research is in the area of analytical spectroscopy with emphasis on development and use of microwave-excited plasmas in a multi-element excitation sources for analysis based on radiant emission. The majority of the work proposed is aimed toward elucidating the mechanism by which microwave energy is transformed into radiant power. The goal is to understand the processes and ultimately to manipulate them to achieve a reproducible plasma of high radiant energy and high atomization efficiency necessary for multi-element excitation. The proposed use of tunable dye lasers as a means of directly probing the plasma and the use of high-intensity magnetic field to control the size and shape of the plasma are innovative approaches which should provide new information on these complex systems. Advances in the area of multi-element emission sources will have beneficial effects on the whole area of atomic spectroscopy as well as many areas of applied chemistry involving trace-element determinations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0034, THEORETICAL CHEMISTRY
D.A. Huckaby, Texas Christian University, AddRan College of Arts & Sciences, Dept. of Chemistry, *2800 S. University Dr., Fort Worth, Texas* 76129 (P-446)

We have proved the existence of an ordered phase in a lattice gas of hard spheres with first- and second-neighbor exclusions on the body-centered cubic lattice. The proof follows that Peierls approach and proceeds by first fixing the boundary with one of the four translationally related face-centered cubic structures which can exist at closest packing. The interior sites are then shown to be predominantly of the same structure at sufficiently high activity, independent of the lattice size. This establishes the existence of an ordered phase.

The cell Cluster methods has been used to calculate the effect of a vacancy defect on the free energy of a harmonic crystal on the triangular lattice. The results of the low temperature limit (zero point energy) have been computed to fifth order and extrapolated to give delta E0/h nu 0 equals -1.038. The high temperature free energy has been extended to fifth order and extrapolated to delta A/kT equals -1.7. Calculations are proceeding on the effect of vacancy defects on the free energy of the face-centered cubic lattice.

SUPPORTED BY Robert A. Welch Foundation

3.0035, COMBUSTION MODELING OF SOLID PROPELLANTS
M.W. Beckstead, Brigham Young University, School of Engineering Science & Technology, Dept. of Chemical Engineering, *B-166 A S B, Provo, Utah* 84601 (DF054900; AFOSR-79-0100)

AF function - nearly all future Air Force rocket propulsion systems will use solid propellants. Deficiency - current analytical and experimental techniques are inadequate for accurate prediction and assessment of the combustion characteristics of these propellants. Objective - the objective of this research is to advance knowledge in four areas needed to understand the combustion of solid rocket propellants. These areas include diffusion flame analysis, aluminum combustion effects in double-base propellants, catalyst effects in composite propellants and distributed combustion effects on propellant response function calculations. How work contributes - the results of this work will provide information needed to improve current analytical and experimental tools for predicting propellant steady- and nonsteady-combustion behavior and rocket-motor performance.

An oxygen-methane diffusion flame burner will be built and used to collect data to assess various assumptions currently employed in application of the Burke-Schumann flame analysis to solid-propellant combustion. A version of the BDP model, modified to account for double-base binders, will be extended to treat aluminized propellants by incorporating a model for aluminum agglomeration. The resulting combustion model will be evaluated by examining predicted effects on burn rate, exponent, temperature sensitivity and combustion response. A version of the BDP model, modified to treat the effects of catalysts, will be evaluated against data currently available on catalyst effects on propellant-combustion behavior. An aluminum agglomeration model will also be coupled to an acoustic calculation to examine distributed combustion effects on propellant-response characteristics by comparing predictions with T-burner data. A steady-state model will also be evaluated in terms of its capability to predict propellant nonsteady-response characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0036, ELECTRONICALLY EXCITED MOLECULAR OXYGEN

E.A. Ogryzlo, University of British Columbia, *2075 Wesbrook Pl., Vancouver, British Columbia, Canada* V6T 1W5 (DF054490; AFOSR-79-0088)

AF function - Air Force operations in surveillance and detection demand a more complete understanding of interferring atmospheric phenomena. Deficiency - there is a lack of understanding of fundamental atmospheric processes that result in airglow. Objective - the goal of this research is to understand the process of production of excited-atomic oxygen and atomic-oxygen recombinations to excited - molecular oxygen levels that radiate energy upon decay. How work contributes -excited states of oxygen are a source of atmospheric 'glow' in regions of overlap with our detection systems. Knowledge of the details of this process will enable discrimination as an interferring light source.

Three undergrade electronically excited states of oxygen will be studied. The excited states will be obtained from gas phase recombination and surface catalyzed recombination of oxygen atoms and mercury sensitization of molecular oxygen. Analysis of the recombination and radiative processes will be accomplished by detailed examination of photon counting, mass spectral and E.S.R. Results: Absolute rate coefficients for the production of 0(1s) will be measured based on emission studies of the 5577 A-line.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0037, LASTING ACTION IN RARE GAS HALOGEN MIXTURES

D. Bates, Queens University of Belfast, *Belfast, Northern Ireland, United Kingdom* (DA0E9303; DAERO 79 G0023)

The proposed theoretical investigation of certain atomic and molecular processes in rare gas halogen mixtures will provide information needed for the development of rare gas-halides and rare gas-rare gas excimer lasers, and are relevant to laser fusion and laser-isotope separation.

Computations will be performed on ionic recombination, electon scattering and photoionization of atoms and molecules, dissociative attachment and recombination, multi-photo action, and free-free transitions for atomic systems.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, FLOW INTERFERENCE PHENOMENA AFFECTING TACTICAL MISSILES

B.Z. Jenkins, U.S. Dept. of Defense, Army, Missile Research & Development Command, Systems Simulation & Development Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1004)

The objective of this investigation is to better define the gas dynamic structure of a rocket exhaust plume in the presence of an external flow stream from subsonic through the supersonic flow regime and its flow interference on rocket performance.

A combined analytical/experimental program has been initiated which will investigate the gas dynamic structure of a rocket exhaust plume. The analytical program will utilize the JANAF standardized plume model (PMS) which is under development as the basic analytical tool. This tool will be supplemented by additional in-house analyses directed at secondary smoke and particle entrainment. PMS will not model the base region but will be compatible with a program being developed at MIRADCOM. Solid or transverse flow plume simulators for wind tunnel use will be employed in the evaluation of the experimental program. Rocket sled testing under actual flight conditions will be employed in the experimental program.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Systems Simulation & Development Directorate

4.0002, PROPAGATION OF SHOCK WAVES IN RANDOM MEDIA

B. Sturtevant, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (ENG78-22089)

Experimental studies will be conducted on the interactions between shock waves and random media. Attention will be directed on the effects of turbulence on shock wave propagation, including scattering and random focusing, and on the effect of shock wave compression on random media, such as vorticity generation, enhanced mixing and subsequent turbulent decay. New optical diagnostic techniques will be developed and information about the propagation of laser light through random media will be obtained as a bonus.

In the long run the results of this research could contribute to, for example, increased understanding of combustion instability and burning rate in burners; the achievement of higher energy release and increased efficiency in high-energy chemical and gas-dynamic lasers; better understanding of transonic shock-boundary-layer interactions, wave drag and boundary-layer separation; and to improve methods for laser transmission.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0003, FILTERED ESB COVERGLASS DEVELOPMENT

P. Iles, Optical Coating Lab. Inc., *Santa Rosa, California* 95403 (DF461550; F33615-77-C-2035)

The objectives of this program are to fabricate and evaluate improved designs of solar cell coverglass/filter configurations for enhanced cell array survivability to natural and military satellite environments.

Design, fabricate, and evaluate improved filtered/ESB 7070 coverglass-cell configurations. Conduct optical tests and thermal environmental tests to verify filter and ESB integrity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0004, HIGH PURITY GaAs BY METALORGANIC CHEMICAL VAPOR DEPOSITION

H.M. Manasevit, Rockwell International Corp., Electronic Devices Division, *3370 Miraloma Ave., Anaheim, California* 92803 (DN980338; N00173-78-C-0195)

The work is aimed to develop a technique for growing high purity layers of GaAs suitable for microwave and electro-optic devices. It further seeks methods to grow large area films capable of being controlled with sharp interfaces and thickness control.

To prepare by metalorganic chemical vapor deposition high purity GaAs layers by attempting to determine and reduce the residual impurities in a) reactants, b) volatile decomposition products and c) materials of construction. Vapor pressure controls will be studied especially in attempting to reduce volatile decomposition product influence on film purity.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0005, RESEARCH ON ALGORITHMS FOR ADAPTIVE ARRAYS
B. Widrow, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF917210; F30602-80-C-0046)

Air Force function - communications. Current deficiency - stable rapid convergence of adaptive algorithms for wideband or narrowband adaptive arrays with large numbers of weights has not been realized. Air Force contribution - advance the technology base to achieve rapid stable convergence of narrowband and wideband adaptive arrays for Air Force ground and air communication applications.

New efficient algorithms will be formulated for narrowband and wideband arrays. Three-dimensional performance investigations will be initiated to further the global understanding of adaptive array antennas. Combined spatial/frequency domain adaptive filtering will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0006, STUDY OF COMPOUND SEMICONDUCTOR SURFACES AND INTERFACES
W.E. Spicer, Stanford University, Stanford Electronics Lab., Dept. of Electrical Engineering, *Stanford, California* 94305 (DN575052; N00014-75-C-0289)

New solid-state electron devices for navy electronic systems continue to be affected by the conditions or properties of the solid surfaces and interfaces. Improvements in techniques to minimize these surface effects will come about as an understanding develops of the role that clean surfaces and chemical effects of impurities have on electrical properties.

Based on the defect model for Fermi level pinning the surface of GaAs will be treated in situ by overpressures of arsenic in an attempt to affect the surface electronic states. Substrate temperatures will be monitored to search for effect of thermal activation on intermixing processes in the formation of Schottky barriers using gold. The effects of strain will be observed using XPS to look at valence band structure and the oxygen sticking coefficient. Various metal or oxygen depositions will be correlated with temperature variation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, STUDY AND ANALYSIS OF TECHNIQUES FOR SIMULATION OF HIGH-RESOLUTION RADAR SYSTEM INTERACTION WITH CITY COMPLEXES
R. Mitchell, Technology Service Corp., *2811 Wilshire Blvd., Santa Monica, California* 90403 (DF226840; F33615-72-C-1583)

This program is directed toward solution of a current training problem in radar landmass simulation. The current analog system and digital systems proposed or under development are not able to provide a radar data base and math model sufficient to portray all detail information manifest in a high-resolution radar systems. Specifically, this effort will address the development of a math model which describes the interaction of a high-resolution radar system with specific features in an urban complex. Testing and validation will be accomplished through comparison with actual imagery.

Portions of a specific city complex that are designated radar significant will be modeled from aerial photography. The basic geometry of each feature will be retained and appropriately coded for storage in computer memory. A math model will be used which describes the complex radar signal interaction with the basic geometries associated with each target feature. The math model will be computer-implemented and the resultant simulation will be compared with actual imagery for validation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

4.0008, EXTREMELY HIGH FREQUENCY MULTIPLE BEAM ANTENNAS
R.W. Major, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Communications Systems & Technology Dept., *San Diego, California* 92152 (DN087529)

Design a multiple beam, EHF, satellite antenna system for reception of shipboard EHF SATCOM transmissions. The system will provide full Earth coverage with multiple spot beams. Enhanced gain of spot beams will facilitate less expensive shipboard antenna systems.

Multiple beam lens theory and past efforts will be reviewed. A design for the antenna aperture, lens, and mixer matrix will be produced. A section of the lens, aperture, and mixer matrix, sufficient to demonstrate the multiple beam capability, will be fabricated/procured. Test to verify system capabilities will be performed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

4.0009, COMMUNICATIONS - IONOSPHERIC TURBULENCE AND MAGNETOSPHERIC-IONOSPHERIC COUPLING FOR EVALUATION OF RADIO COMMUNICATIONS
J.E. Maggs, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN323099; N00014-76-C-0307)

The objective is to evaluate the effect of the ionosphere on radio communication systems used in Navy operations and to help in the design and operation of such systems. The propagation and attenuation of high-frequency, very low-frequency, and very high-frequency radio signals by the ionosphere, by both ground-based and satellite transmitters, are governed by the electron and ion densities in the ionosphere. The present work developes a model to estimate these electron and ion densities as a function of latitude, longitude, altitude, season, time and solar activity.

Work consists of a theoretical investigation of ionospheric plasma turbulence and magnetosphere-ionosphere interactions. Specifically, this includes the use of analytic techniques, models, and computer programs to investigate plasma physics of auroral ion beams, relativistic electron precipitation and its effects on the lower D-region, turbulent heating of cold electrons escaping from the ionosphere, upper hybrid turbulence effects, and the spatially inhomogeneous nonlinear saturation of electrostatic whistlers and upper hybrid noise generated by the auroral beam.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, FUNDAMENTAL RESEARCH OF MOLECULAR BEAM EPITAXY FOR DEVICE APPLICATIONS
R.L. Bell, Varian Associates Inc., *611 Hansen Way, Palo Alto, California* 94303 (DF057080; F49620-80-C-0011)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, communications, electronic countermeasures, navigation, and command and control systems. These devices can be greatly improved with the developments being made in molecular beam epitaxy (MBE) systems. Opportunity - the incorporation of impurities, intentional and unintentional, is probably the least understood area of MBE. Unfortunately, most, if not all, dopants presently used in MBE suffer at least one disadvantage which prevents one from obtaining either abrupt changes in dopant concentration, or electrical (and/or optical) material properties. No 'ideal' donor impurity has yet been discovered for the growth of N-type GaAs by MBE. The situation for P-type dopants are even more rudimentary. Objectives - to significantly advance the understanding of the fundamental of MBE for submicron device application and determine optimum dopants. How work contributes - the effort advances microwave, millimeter and optoelectrics device technology.

Conduct thermodynamic studies of dopant incorporation to evaluate the net active dopant concentration as a function of growth parameters using such analytical tools as SIM profiling, photoaluminescence, He4 backscattering, Hall mobility and carrier freeze out as a function of temperature, deep level transient spectroscopy and minority carrier lifetimes measurements. Incorporate different dopants (using different source of dopants) to determine the optimum N-type and P-type dopant.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, FAR-UV ENVIRONMENT SENSOR DEVELOPMENT (CO-OP)

G.R. Carruthers, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN920017)

To design improved ultraviolet imaging systems suitable for application to missile surveillance and intercept missions for the Navy. Sky surveys with such systems will provide simplified space reference guidance and orientation. Initial steps in developing applications involve studies of ultraviolet emissions from rocket exhausts, development of new sensors and imaging devices, and measurement of the natural ultraviolet radiation environment against which targets of interest must be observed.

Develop far-UV image converters of improved sensitivity and photometric linearity. With the above carry out direct measurement of natural emissions in far ultraviolet wavelength ranges not accessible from the ground, thereby determining the background against which military systems using far-UV emission must operate. Observe any emission resulting from a vehicle passing through the upper atmosphere. Determine the physical conditions responsible for far-uv emission in natural objects.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0012, RADIO INTERFEROMETRY

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Provide scientific data and investigate interferometer techniques leading to improved capabilities for application in areas of precise time, polar motion, astronomical constants and position reference systems, position determination, time transfer, navigation, geodesy and surveillance.

Conduct research leading to precision radio interferometer techniques with application to determination of UT, polar motion, and other earth rotation parameters, accurate position location on Earth and in space, and time transfer over global distances. Map and investigate celestial radio sources by interferometer techniques. Determine improved astronomical position reference system using radio sources coupled with standard star systems. Evaluate source characteristics and environmental and instrumental limitations. Provide R&D support and technology transfer to USNO for operational applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0013, FREE ELECTRON LASERS

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The two prime issues which this theoretical research program will address are (1) methods of enhancing the single-pass efficiency and (2) schemes for reducing the electron beam energy requirements necessary to achieve optical radiation (two-stage FEL).

The approach will be to formulate a fully non-linear self-consistent theory of FELs. In this theory the pump magnetic field will have a spatially dependent amplitude and wavelength.

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0014, DEVELOPMENT OF LOW LEVEL DAYTIME CIG FOR LIGHT TRAINING

J.L. Booker, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, *Orlando, Florida* 32813 (DN894006)

Continuing review of hardware technology for CIG, development of new architectural approaches, development of new methods of data base programming, and developing applications of CIG technology in training simulations in new areas such as submarine periscope navigation and helicopter nap-of-the-earth flight modes.

The following major tasks will be implemented: (1) continuing review of CIG hardware technology; (2) development of new CIG architectural appraoches; (3) develop trial environments for nap-of-the-earth flight missions and submarine periscope navigation simulators.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Experimental Computer Simulation Lab.

4.0015, NAVY ENVIRONMENT - SATELLITE RAIN DATA

H. Hiser, University of Miami, School of Engineering & Architecture, Dept. of Mechanical Engineering, *Coral Gables, Florida* 33124 (DN624020; N00014-75-C-0172)

The objective of this research is to apply remotely sensed high resolution digitized radar data on rainfall to the calibration of lower resolution satellite data with the purpose in mind of getting better information on ocean rainfall in support of naval operations at sea.

Satellite digital data used in this research comes from the University of Wisconsin man-computer interactive data access system (MET - stationary satellite). Other digitized rainfall data is supplied by the NOAA National Environmental Satellite Service. The NASA Goddard Space Flight Center, and the National Hurricane Center. For calibration of the digitized radar data hourly rainfall amounts are available from the National Data Center at Asheville and from a special network of gauges 50-70 miles north of the radar and operated by the NOAA National Hurricane and Experimental Meteorological Laboratory. The radar and associated equipment for recording the digitized rainfall data is supplied by the Army.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, COMPARISON OF MINI'S AND MAIN FRAMES IN SOLVING STRUCTURAL ANALYSIS PROBLEMS

R. Haftka, Illinois Inst. of Technology, Armour College of Engineering, Dept. of Mechanics Mechanical & Aerospace Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (DN075307; N00014-80-C-0364)

In the process of carrying out structural analyses of various types of naval problems including submarines, aircraft, missiles, it is necessary to use computerized approaches. Decisions must constantly be made to which computer to use, which program to select, and what mathematical model to employ. The results eminating out of the effort described here should be most helpful in this decision process.

A number of structural analysis test problems will be run on various mini and main frame systems located in-house or at data centers. Comparisons will be made of CPU time, storage requirements, and people time necessary to effect solutions. The significance of interactive access to the systems will also be explored. Analysis types include linear static problems, eigenvalue analyses, nonlinear response including large deformations, and transient dynamic analysis. Computer systems employed include Prime 400, UNIVAC 1181, CYBER and Xerox 940.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0017, ACOUSTO-OPTIC SIGNAL PROCESSING

J.N. Lee, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0F5595)

To investigate the transient effects of x-ray pulses and the permanent effects of gamma-ray and neutron irradiation on surface acoustic wave (SAW) devices. To build a real-time convolver having a time-bandwidth product of 10,000 (interaction time of 40US and and 250 MHz bandwidth).

The transient radiation effects studies at the HDL high intensity flash x-ray (HIFX) facility require measurement of small transient changes of RF signal amplitude or of phase during and immediately after the x-ray pulse. For the permanent damage studies, device characteristics are measured both before and after each exposure. The convolver will utilize the interaction in a six-inch long wafer of LiNb0-3 of a sheet laser beam with a surface acoustic wave. A long acoustic bandwidth will be achieved by using three sets of interdigital saw transducers in parallel.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Harry Diamond Lab.

4.0018, MERCURY-CADMIUM TELLURIDE FOCAL PLANE ARRAY TECHNOLOGY

R. Broudy, Honeywell Inc., *2 Forbes Rd., Lexington, Massachusetts* 02173 (DN780200; N00173-77-C-0335)

The objective of the program is the development of an infrared detector array and signal processing technology using mercury-cadmium telluride as the detection medium.

This program involves the development of a hybrid focal plane array technology using HgCdTe photo-diode detector arrays which are mechanically and electrically interfaced to a silicon CCd signal processor. The silicon contains the detector coupling circuit, the TDI registers, and a multiplexer.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0019, RELATIONSHIP OF ABLATIVE MECHANISMS TO FIBER PERFORMANCE AGAINST LASERS

J. Caldarella, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0J4216)

The objective of this effort is to determine the mechanisms of ablation and other breakdown patchways when fibrous polymers and other materials of potential value in individual protection are exposed to infrared CW laser radiation.

Selected polymeric materials will be exposed to controlled laser irradiation at 10.6 microns and other wavelengths of interest. Delineation of breakdown processes will be sought by examination of volatile condensible materials and residues with and without positive removal of ablative material.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0020, HIGH LEVEL PARACHUTE FORCE TRANSFER DEVICE

M. Gustin, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4258)

Establish the design parameters for a coupled height sensor and first-to-second stage deceleration force transfer device for the high level platform airdrop system (HLPADS). The coupled sensor-force transfer device will permit airdrop of heavy equipment from altitudes of 10,000 ft to 25,000 ft above ground level and thereby place the airdrop aircraft out of the range of small surface-to-air missiles.

Feasibility testing of a complete high level airdrop system using a prototype height sensor-force transfer coupling will be conducted and force data collected to permit establishment of the design parameters.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0021, NON-UNIFORMITY INVESTIGATIONS IN GLOW DISCHARGES

L.M. Chanin, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (ENG79-03775)

The research includes the following topics: A. Alternating Current Excited Cataphoresis. B. Temporal Cataphoresis Studies. C. Cataphoretic Segregation in Metal Vapor-Noble Gas Mixtures. Under A. measurements are undertaken of alternating current cataphoresis on gas mercury mixtures using recently developed techniques. The mercury noble gas alternating current cataphoresis measurements in combination with existing noble gas mixture data can provide a reliable basis for further development of a theoretical model of alternating current cataphoresis. Under B. the research undertakes a direct comparison of optical and mass analysis measurements of the influence of electrode and discharge tube volumes on cataphoretic segregation rates. Under C. it is planned to measure the axial distribution of the radiation from various excited species in helium metal halide discharges such as stannous chloride, zinc chloride, and aluminum chloride. An interesting feature of cataphoresis in helium metal halide discharges involves the presence of negative ions. This condition may be very important for many gases which form negative ions in discharges. The research is a continuation of that done under NSF Grant ENG76-09269.

The funding covers the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0022, LASER HARDENING THROUGH FLUID MECHANICS

H.W. Kipp, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF133150; F33615-78-C-3002)

Air Force vehicles operating at moderate to high speed may be subjected to laser attack in the near future. This induced thermal environment must be properly considered in the design process of future vehicles. Methods by which this threat may be countered or reduced must be explored. This work unit will explore the possibility of dissipating laser energy at the vehicle's surface through techniques of fluid mechanics. By ejecting a fluid into the boundary layer over critical vehicle components the laser energy may be dissipated thereby protecting the vehicle from critical damage and assuring mission success.

Through both experimental and analytical means this work unit will investigate the interactions between fluid flowing over a surface and various levels of impinging laser energy. Different fluids will be examined as a means of dissipating the laser energy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0023, FEASIBILITY OF METEOROLOGICAL RPV PROBES

R. Rubio, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sciences Lab., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0F2115)

A need is anticipated by the Army Atmospheric Sciences Laboratory for a maneuverable, versatile and economical method of gathering meteorological data in the atmosphere over the High Energy Laser Systems Test Facility (HELSTF) at White Sands Missile Range. An appropriately designed RPV would provide a capability to quickly and inexpensively transport meteorological sensors to various locations and altitudes to provide a method for measurements along specifically designated paths.

Johns Hopkins University (JHU), funded jointly by ASL and ARO, will provide, under contract RPV's capable of performing meteorological investigations at altitudes to 20K feet ND ranges to 20km. A 15 lb payload of meteorological sensors, power supply and data telemetry link will be interfaced with RPV. Flight test will be conducted along specified trajectories within the boundaries of the HELSTF sites. The telemetered signals from the sensors will be recorded by groundbased systems. The RPV will be tracked by WSMR radars. The meteoro-

logical sensor data vs time, when coupled with the radar RPV position data vs time will provide meteorological data vs position over the HELSTF.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

4.0024, INVESTIGATION OF ROTATING STALL IN AXIAL FLOW COMPRESSORS

G. Ludwig, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF463460; F33615-79-C-2023)

This effort will create a three-dimensional time variant rotating stall and compressor stability theory. This unified theory will include acoustic as well as aerodynamic phenomena. Create a flight worthy control circuit utilizing this work to prevent compressor stall and surge.

Rotating stall is the incipient compressor stall and surge initiator. Therefore, this effort concentrates on the fundamental, theoretical, and empirical understanding of rotating stall from cascade rigs through turbine engines.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0025, SURVEILLANCE AND COMMUNICATION SUPERCONDUCTING DETECTORS

R. Buhrman, Cornell University, Ithaca Campus, School of Engineering, Dept. of Applied & Engineering Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (DN675284; N00014-76-C-0526)

This contract is studying the electronic properties of submicron size superconducting tunnel junctions of direct interest to the navy for surveillance, communication and signal processing. Those specific properties required for practical, optimum and reliable operation are being studied in detail.

Submicron size superconducting tunnel junctions containing tunneling barriers made of various oxide and composite materials are being prepared and various electronic properties will be studied. The properties, limitations and digital applications of superconducting micro-tunnel junctions are being investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0026, ANALYSIS OF THE NOAA ALASKAN MST RADAR SYSTEM DATA

M.C. Kelley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DF057470; AFOSR-80-0020)

AF function - satellite ephermeris and missile trajectory predictions, missile plume and nuclear effects modeling, ionospheric modeling in support of OTH-B and communications and analyses of the effects of AF operations on the stratosphere are all impacted upon by the dynamics of the region between the Earth's surface and 100 km altitude. Deficiency/opportunity - no capability exists for continuous high time resolution measurements of the winds and turbulence throughout this region. Studies by the NOAA Aeronomy Laboratory have shown that a 50 MHz radar with sufficient aperature/power should find sufficient refractive index gradients to provide sufficient backscatter throughout the region. Under NSF, and some OSR support, NOAA is constructing a radar near Poker Flats, Alaska. A quarter of the dipole array has been providing initial measurements since early spring 1979. The opportunity exists therefore to assist in the generation of a research using a new and unique research tool. How work contributes - theoretical studies of middle atmospheric tides and gravity waves driving the ionosphere are in need of corroborating data. Diffusion studies in the stratosphere and wave/wave coupling studies also require fine scale measurements of the dynamics. The MST radar will provide these measurements.

This work effort will couple a strong research team in radar studies at Cornell University with the Alaskan radar. It will also add a meteorolorist to the research teams. The Cornell group will assist in establishing research goals, measurement methodology, data analysis and interpretation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, NONLINEAR ANALYSIS OF INTERFERING BODIES IN SUPERSONIC FLOW

F. Marconi, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF057890; F49620-80-C-0044)

AF function - advanced aerospace vehicles. Deficiency - sufficiently accurate theoretical prediction methods are not available for assessing the feasibility of store carriage and store separation in supersonic flight. Before suitable engineering methods can be developed, procedures must be divised for modeling the complex shock wave interactions which occur. Objective - to determine the suitability of a numerical shock fitting scheme for computing the complex shock patterns occurring for supersonic flow past an axisymmetric body in close proximity to a surface. In particular, to determine whether or not the transition from a regular shock reflection to a Mach disk reflection can be modeled. How work contributes - if successful, the investigation will provide the necessary foundation for the development of an analysis tool to overcome the deficiency noted.

The three-dimensional form of the Euler equations will be solved using a shock-fitting, finite difference scheme first developed by Moretti. Appropriate mappings will be devised to provide a suitable computational grid for the problem of an axisymmetric body in close proximity to a wall, and the complex characteristics-based difference scheme will be streamlined in order to reduce the computer time required. The principal effort will involve attempts first to minimize the logical difficulties associated with tracking complex shock patterns and then to determine if the method will simulate the transition from regular shock reflection to a Mach disk reflection. Validation of the procedure will be accomplished by comparison with appropriate experimental data and computational results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, COMMUNICATIONS - NONLINEAR AND TURBULENT WAVE INTERACTIONS

N. Marcuvitz, Polytechnic Inst. of New York, Long Island Center, School of Engineering, Dept. of Electrical Engineering & Electrophysics, *Farmingdale, New York* 11735 (DN723110; N00014-76-C-0176)

The performance of Navy and DOD transionospheric communications systems is degraded by amplitude, phase, and angle scintillations. Fundamental research on radio propagation through plasma irregularities based on advances in understanding the nature of the plasma instabilities responsible for the irregularities could lead to optimum coding or modulation of radio waves to minimize loss of information. This research will also explore the interaction of intense radio waves (including microwave) with the ionosphere.

The growth and saturation of plasma instabilities in the ionosphere is being studied using nonlinear kinetic theory to determine the correlation spectrum of electron density fluctuations. The propagation of electromagnetic waves through the turbulent ionosphere is being examined. Nonlinear electromagnetic-ionospheric interaction mechanisms that lead to turbulent heating and particle diffusion is being examined using kinetic quasi-particle techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0029, OPTICAL-MICROWAVE INTERACTIONS IN SOLID-STATE DEVICES

R.J. Gutmann, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Electrical & Systems Engineering, *110 8th St., Troy, New York* 12181 (ECS79-24399)

Effects of optical excitation on signal and noise characteristics of microwave devices are being investigated. The program contains both experimental and theoretical elements and involves measurements with both commercial and laboratory fabricated devices. One programmatic concern is further under-

standing of the relative role of holes and electrons in photo-induced noise power reduction in silicon IMPATT (impact avalanche and transit time) oscillators. Variable wavelength optical excitation is used in these experiments to separate hole from electron generation. Photocurrent effects on gallium arsenide IMPATT and MESFET (metal-semiconductor field effect transistor) oscillators are also being studied in the interest of establishing the range of parameter variations that can be achieved and exploring new optoelectronic device concepts. Examples of concepts to be explored include optical phase locking of fast rise time switches and pulse generators and optical tuning of microwave oscillators.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0030, VLF/LF IONOSPHERIC PROPAGATION
J.E. Rasmussen, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904180)

AF function - communications, navigation and detection in the long wave radio spectrum. Deficiency/opportunity - improve the range, reliability and survivability of VLF/LF communications. Improve the accuracy, predictability and reliability of VLF (Omega) navigation systems. The objective is to originate and develop new long wave electromagnetic techniques which will significantly advance ionospheric radio propagation technology for Air Force communications, navigation and detection systems. This work will emphasize the evaluation and improvement of VLF and LF air-to-air system survivability in a nuclear environment. How research contributes - provides the experimental measurements and theoretical modeling required to understand long wave radio propagation under normal as well as severely disturbed ionospheric conditions and to determine the engineering parameters critical to VLF/LF system design.

The signal strength or coverage area for VLF and LF radio waves as a function of altitude is a critical propagation parameter for the design and evaluation of af long wave systems. Under this work unit a theoretical and experimental program will be conducted to determine the energy distribution of Te and Tm polarized waves with altitude. This study will utilize balloon-borne dartsonde packages, rocket payloads and instrumented aircraft to measure both signal and noise as a function of polarization. The primary factor which controls the altitude distribution, and long wave propagation in general, is the reflectivity of the lower ionosphere which will also be studied utilizing a high resolution pulse ionosounder located in the Arctic, where solar-related particle events provide the best available simulation of the low altitude absorption features expected in a nuclear environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0031, CHARACTERIZATION OF ION-IMPLANTED COMPOUND SEMICONDUCTORS
E.T. Rodine, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF104990; F33615-76-C-1166)

Present solid-state microwave and opto-electronic devices employed in AF avionics systems require improved reproducibility and reliability. One specific application of output from this research is to improve the performance of such devices by applying ion implantation to the material preparation and device fabrication. The objectives of this experimental program are to characterize ion-implanted epitaxial and substrate compound semiconductors such as gallium arsenide (GaAs), indium phosphide (InP), gallium phosphide (GaP), and other related compounds and to assess the utility of ion implantation techniques for device fabrication and development of bulk and thin film GaAs, InP, and GaP materials for microwave, high speed logic and electro-opitcal device applications.

The work will utilize ion implantation as a principal technique for doping materials with a wide variety of ions in a reproducible manner. This is a thorough program in which (1) the pre-implanted material is carefully characterized, (2) the implantation process is precisely controlled and analyzed w/suitable techniques as needed, (3) the implanted layers are characterized by capacitance-voltage (C-V), differential Hall, distributed resistance capacitance (RC) measurements and deep level trap spectroscopy (DLTS). Emphasis will be placed on the investigation of the electrical properties of the implanted layers which are pertinent to device fabrication. Different contacting strategies for the production of high-quality ohmic contacts such as the production of highly doped contacting layers by implantation and the use of heavy ion surface radiation damage as a prelude to contact formation will be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0032, LOW EMISSIONS VARIABLE GEOMETRY COMBUSTOR
R. Henderson, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF336520)

A research program to accomplish the technical objective will be established by the Air Force Aeropropulsion Laboratory (AFAPL). The work will involve a dual award contract with industry. Program technical direction and funding is provided by AFESC, AFAPL, and the Naval Air Propulsion Center (NAPC). AFESC will be represented on the technical proposal evaluation team and throughout the program will provide technical expertise in the area of pollutant emission measurement and date evaluation. This JON covers Phase I, Preliminary Design and Development. Continuation into Phase II, Final Design, Fabrication and Component Testing, if warranted, will be conducted under a follow-on JON. A joint TR for Phase I will be published in FY 81. At AFAPL the Phase I work is being conducted under JONS 30660545 and 30660544.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0033, COMBUSTION MODELING
J. Petty, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF466030)

Development of two combustor computer codes - a combustor interactive design system (CIDS) and a combustor analysis code (CAC).

The CIDS will be developed with a block-type structure similar to the AFAPL turbine design system to provide a fast interactive design tool. The CAC will be developed to be the most accurate possible code for combustor aerothermodynamic analysis within computer limitations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0034, NUMERICAL-CONTROLLED ORBITAL FORGING PROCESSES
J. Carleone, Dyna East Corp., *227 Helmlock Rd., Wynnewood, Pennsylvania* 19096 (DAR80-09693)

This project is an investigation of the feasibility of numerically controlled orbital forging in discrete parts manufacturing. Studies are made of 1) sensitivities to controlling parameters, 2) flow processes in metals, 3) the use of a feedback mechanism for control. Operator-controlled orbital forging is known in some European countries but virtually unknown in the United States.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

4.0035, FEASIBILITY DEMONSTRATION OF A RETARDATION AND AUTOMATIC FLOTATION (RAFT) SYSTEM FOR THE 'VERTREP' MISSION
W. Wiesmann, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN681034)

Demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free fall and subsequent flotation of high value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment

operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water to avert sinking and to facilitate recovery by surface ship or helicopter. The system will be readily adaptable to all helicopters which are normally used in the VERTREP mission. This work is supported by Work Units PH104B and PH104B1.

It is planned to study, analyze, design and test equipment to facilitate recovery of a nuclear weapon or other high value cargo which is separated from a helicopter during vertical replenishment operations over water.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Tech Admin.

4.0036, ADVANCED AERODYNAMIC CONCEPTS
K.T. Yen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN481077)

To conduct research in promising areas of advanced aerodynamics, i. e., technologically efficeient areas of unique interest to the U.S. Navy.

Through continuing review of the aerodynamics S.O.A., identify areas of significant technological deficiency and establish priorities based upon Navy unique requirements, impact on operational effectiveness, economy of development and solution risk. See qualified sources to perform the work, administer study contracts and provide in-depth technical monitoring and overall program management. Some work is also performed on contract as reported in Work Units NN701B6, NN701B10 and NN701B11.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0037, ASTRO GEODETIC MEASUREMENT OF VERTICAL DEFLECTION WITH GPS AND ADVANCED INS
J. Calabria, U.S. Dept. of Defense, Navy, Naval Air Development Center, Communication Navigation Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881606)

Determine feasibility of improving vertical deflection measurement techniques. It may now be possible to obtain more accurate measurements by using new shipboard systems such as advanced inertial navigation system (INS) and global positioning system (GPS). These new shipboard systems provide precise astronomical geodetic measurements directly and continuously. Another potential aspect of this project is the further reduction of the time required for gravity surveys using airborne systems which would be the logical follow-up.

Perform theoretical analysis of advanced INS and NAVSTAR GPS output as a means to detect and identify deflection of the vertical problem; involves separating the desired output from INS errors and from geodetic reference errors. The following steps will be taken: A. Consider INS GPS configurations and develop algorithms for vertical deflection measurement in conjunction with the normal INS data processing procedure, e.g., optimal filtering. B. Write a simulation computer program using the algorithm developed in step A. This will use both artificial and real data as available. C. Perform computer simulation and ascertain accuracy of vertical deflection measurement and INS error reduction. D. Investigate real-time implementation requirements and requirements for operational system changes and perform quick look feasibility analysis of shipboard data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0038, INFLATABLE ANTENNA TECHNIQUES
A.J. Stanland, U.S. Dept. of Defense, Navy, Naval Underwater Systems Center, *Newport, Rhode Island* 02840 (DN989036)

Investigate materials, processes, and deployment techniques for collapsible antennas to be used on expendable buoy systems, specifically, buoys for launch thru the existing signal ejector tube (3-inch launcher).

Historically, buoy design and electrical function have been restricted by the limited volume available for the antenna within the buoy. Larger antenna apertures, additional functions, such as SSIXS and ASWIXS, and improved performance are possible by collapsing the antenna radiating structure during launch and, at the surface, extending the antenna to its operating size. The development will consist of the following phases: material investigation directed toward collapsed structures and/or printed circuit antenna types, defining antenna performance goals versus function, surface deployment methods, and inflatable structures for improved surface stability, laboratory development models would be made as well as contracts to industry for development of specific areas of expertise. Feasibility models would be made and tested. A final report and recommendations would be issued.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Electronics System Command

4.0039, DISTRIBUTED LOADS TECHNOLOGY
R. Dix, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421057; F40600-77-C-0003)

To develop techniques to both analytically predict and experimentally measure distributed aerodynamic loads on a STORE in an interference flow field.

Gross and distributed loads calculations from modified CAMS 045 program will be compared with experimental data. Feasibility of modifying the program to calculate distributed loads in an interference flow field will be investigated. Neilsen STORE separation program will be considered for possible use in making distributed loads calculations. Design-criteria and test-requirements will be established for a segmented model to measure distributed loads.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0040, ICRH INSTALLATION ON EBT-S CONFINEMENT: ALTERNATE CONCEPTS
J. Sheffield, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (003826 TICNO; 00139(19))

The suitability of ICRH on EBT-S will be studied. These studies will be conducted primarily by teams from industrial concerns -specifically McDonnell-Douglas and TRW - in conjunction with ORNL personnel. These studies will consist of theoretical investigations of the interaction of the RF power with the plasma, e.g., coupling, penetration, and heating, as well as experimental studies of these characteristics at low power levels. The assumption underlying this Field Task Proposals/Agreement is that the preliminary studies are sufficiently encouraging to warrant a significantly increased effort in applying ICRH to EBT-S.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Fusion Energy

4.0041, RF EMISSIONS FROM PLASMAS
J.R. Roth, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Electrical Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DN075003; N00014-80-C-0063)

The Navy needs quantitative information on mechanisms of excitation of low frequency RF radiations in the lower ionosphere, which are capable of interfering with submarine communications. These mechanisms will be investigated in the laboratory in an electric field dominated plasma, in which a variety of turbulent, nonlinear phenomena occur. Particular attention will be focused on the newly discovered RF emission at the geometric mean plasma frequency.

An experiment will be set up from existing equipment and conducted in order to study the scaling, efficiency, and range of occurrence of the newly discovered RF emission at the geometric mean plasma frequency, in electric field dominated plasmas. Other RF emission mechanisms in these plasmas will also be investigated experimentally and analytically.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0042, WIDE ANGLE MULTI-VIEWER INFINITY IMAGE DISPLAY
A.L. Zepf, American Airlines Inc., *Fort Worth, Texas* (DF228790; F33615-79-C-0002)

The purpose of this effort is to determine the feasibility of fabrication and to evaluate the potential optical performance of an optical display to provide the out-the-window scene for a multi-crewmember cockpit. Parallel design studies sponsored by AFHRL have recently recommended a large spherical mirror viewed off-axis as the imaging system most likely to meet the design goals stated. Because the technology to produce these large mirrors is untried and considered to be high risk, this effort will reduce the risk prior to fabrication of a full scale demonstration system by developing basic fabrication techniques on a smaller scale.

Based on the results of the previous parallel design studies, a final design will be developed to resolve the differences between the study results. Various fabrication techniques for the large mirror and for the rear projection screen will be investigated and one will be selected for further development. Assembly and alignment procedures will be developed and a small test section will be fabricated to permit evaluation of the fabrication and assembly methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

4.0043, TURBULENT BOUNDARY LAYER SEPARATION IN ADVERSE PRESSURE GRADIENT
R.L. Simpson, Southern Methodist University, School of Engineering & Applied Sciences, Dept. of Civil & Mechanical Engineering, *Hillcrest & University, Dallas, Texas* 75222 (DN975360; N00014-79-C-0277)

The objective of this study is to improve current knowledge on the role of large eddies and the structure of turbulence in the region of boundary layer separation for adverse pressure gradients. Such information is needed for better design of diffusers and blade passages in aircraft turbojet engines, and ultimately should lead to improved propulsion systems for naval weaponry applications.

A single velocity component fringe-type directionally-sensitive fast scanning laser anemometer, with a small scan time compared to the large eddy structure time scale, shall be constructed to obtain nearly instantaneous velocity profiles in the region of separation. A data acquisition system shall be developed to temporally record the profiles, and the results shall be conditionally average to study the large eddy structure.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0044, SILICON ON INSULATOR MICROWAVE FETS
L. Hon Wai, Texas Instruments Inc., *13500 N. Central Expy., P.O. Box 5621, Dallas, Texas* 75222 (DN975748; N00014-79-C-0790)

This work seeks means of effectively using silicon semiconductors for microwave FET applications in navy electromagnetic systems.

Amorphous silicon deposited on amorphous substrates of high thermal conductivity and low microwave dielectric loss tangent will be recrystallized via lasers and/or electron beams. Charge carrier transport properties within the recrystallized silicon will be determined and optimized in an iterative manner. RF microwave FETS will be fabricated and tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0045, LOW ALTITUDE NAVIGATION SIMULATION
D. Johns, Boeing Co., Boeing Aerospace Company, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN097591; N00123-79-C-1461)

To develop a program for training Marine Corps fixed wing pilots in navigation and target acquisition techniques that will allow them to operate at low altitudes over unfamiliar terrains. This contract supports in house work unit entitled, USMC Air Navigation Training, DN797567.

Map interpretation, terrain analysis, and target acquisition techniques will be developed and evaluated. Materials and methods will be field tested using cinematic and sensor simulation support. Flight navigation problems specific to USMC operational requirements will be surveyed and recommendations forwarded.

SUPPORTED BY U.S. Dept. of Defense, Navy, Personnel Research & Development Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, VECTOR FIELDS STUDY
K.R. Krall, U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center, *Huntsville, Alabama* 35812 (DF584000)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions of AF communications and detection systems. Objective - develop techniques for forecasting solar flare activity. How research contributes - improve knowledge of the flare energy build-up process, providing new capability for assessing, in advance, the flare potential and location. Such capability would allow short-term (days or less) predictions of flare incidence and probable geophysical effects.

Observations of sunspot dynamics, chromospheric structures, and vector magnetic fields will be coordinated to study the flare energy build-up. Particular emphasis will be placed on the evolution of magnetic shears and emerging magnetic flux in relation to the locations, sizes and incidence of flares.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0002, WATER TRANSFER IN THE SOIL-PLANT ATMOSPHERE SYSTEM AS RELATED TO WATER CONSERVATION
R.D. Jackson, U.S. Dept. of Agriculture, Agricultural Research, Plant Environment Optimization Res, *4331 E. Broadway, Phoenix, Arizona* 85040 (0040693; 5510-20760-001)

OBJECTIVE: Determine the nature and magnitude of interrelated physical, chemical, biological and meteorological processes associated with water transfer in soil, plants and the atmosphere, with the goal of reducing water losses and of improving water use efficiency.

APPROACH: Conduct detailed theoretical and experimental laboratory and field studies concerning water, salt, heat and gas transfer mechanisms within the soil and atmosphere on a diurnal and seasonal basis. Identify key environmental properties that affect transfer mechanisms, and determine management practices that alter these properties to reduce water losses. Develop remote sensing techniques for estimating soil water content, evapotranspiration, and plant water stress over large areas for crop yield prediction, irrigation scheduling and hydrologic studies. Utilize controlled environment chambers as tools to study transpiration and photosynthesis in detail. Develop design criteria and operating procedures to maximize water use efficiency and crop yields in controlled-environment structures.

PROGRESS: Runoff farming using paraffin-coated catchments brought about a 4- to 8-fold increase in native jojoba seed yields. CO(2) enrichment of unventilated greenhouses increased tomato yield by 50% during spring months but had no significant effect during fall months. Enhanced CO(2) levels did not affect taste, had no significant effect on vitamin C, but slightly increased vitamin A content of tomatoes. The stress-degree-day technique of yield prediction was shown to be valid for three years data for one wheat variety. Data for a second wheat variety and for barley overlapped the data for the first variety, implying the generality of the stress-degree-day concept. A yield model was developed that utilizes measurements of reflected radiation to estimate crop senescence rates. Yields of two varieties of wheat and a barley fit the model. Infrared thermometry was used to detect biological stresses in cotton and sugarbeets. Equations were developed to describe the dependency of the cloud-

less sky thermal radiant emittance on surface water vapor pressure and air temperature. Low-level dust was shown to be more effective in retaining heat near the Earth's surface than high-level dust. Emittance calculations showed that the warming effect due to a doubling of the atmospheric CO(2) content is about 0.7C. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research, Arizona - New Mexico Area

5.0003, MERCURY GEOLOGIC MAPPING

H.E. Holt, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-01856)

The overall objective of this project is the publication of a Geologic Atlas of Mercury composed of all or parts of 9 quadrangle maps at a scale of 1:5,000,000. Geologic mapping is based on the photographic data returned by Mariner 10 during its flybys of the planet Mercury in 1974-75. The procedure of analysis involves dividing the surface rocks into geologic units and mapping their distribution. The surface of Mercury records successive events that modified surficial distributions of materials; events resulting from internal processes such as volcanism and tectonism, as well as the external mechanism of meteorite impact. The resulting geologic maps will depict the stratigraphy and structure of the surface materials from which the sequence and nature of the major events that have affected the planetary surface can be recognized. A geologic and tectonic evolution of Mercury will be derived from the resulting geologic mapping.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, CHARGED-PARTICLE BEAM INJECTION STUDIES

H.J. Linnerud, Jaycor, *1401 Camino Del Mar, Del Mar, California* 92014 (DF583530; F19628-79-C-0121)

AF function - satellite survivability and communications. Deficiency - the space-environmental effects of beam injection experiments are not fully understood. Objective - to gain an understanding of the effects on the vehicle and ambient plasma of charged-particle beam injection from a vehicle and the characteristics of the beam in the vicinity of the vehicle. How research contributes -will provide a basis for assessing the effect of charged-particle beam injection into the ionosphere.

Pertinent theory and experiments in the literature will be studied. Effects of charged-particle injection in the ionosphere in the vicinity of the vehicle will be calculated. These will include the steady-state and time-dependent vehicle potential, the charge-current emission limitations, secondary electron and ion effects, and the energy spectrum of the beam leaving the vicinity of the vehicle.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0005, REMOTE WIND MEASUREMENT USING ACOUSTIC ANGLE-OF-ARRIVAL TECHNIQUE (13850-GS)

P.B. Russell, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DA0F9186; DAAG29-78-C-0009)

To investigate the feasibility of the acoustic angle-of-arrival technique for remote wind profile measurements. Relevance: The acoustic angle-of-arrival technique has good potential to provide remote wind profile measurements over the spatial and temporal scales required for Army aircraft operations, defense against CB attack, smoke screening, low altitude paradrops, and ballistic corrections for tube artillery and rockets.

Compare wind profile measurements obtained with an array of acoustic transmitters/receivers with wind, temperature and turbulence profile measurements from the Sutro Tower in California and the NOAA/NCAR Joint Meteorological Observation Facility Tower in Colorado. Under a variety of atmospheric conditions, investigate the effects of refraction of acoustic ray paths by temperature variation, destruction of phase coherence by turbulence, and loss of acoustic return signal (relative to background noise) on accuracy and operational effectiveness of the technique.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0006, REMOTE SENSING OF THE OPTICAL AND PHYSICAL DENSITIES OF SMOKE, DUST AND WATER CLOUDS (16692-GS)

E.E. Uthe, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DA0G2120; DAAG29-80-C-0003)

To develop a LIDAR remote sensing technique to measure IR transmission, particle size information and mass concentration along propagation paths through smoke and dust clouds. Relevance: Applicable to remote sensing of simulated battlefield smoke and dust conditions. If the transmission and range-integrated backscatter relationship can be derived, range-integrated backscatter measurements on slant paths thru smoke and dust clouds may be used to probe the elevated portions of such clouds.

A third LIDAR wavelength (3.3 microns) will be added to the two wavelength system (1.06 and 10.6 microns) now used by SRI. This 3 wavelength system will be fielded during an Army field test program and the data collected will be analyzed to determine the correlation between extinction and range integrated backscatter, transmission and mass concentration. The two-way transmission and backscatter information at all three wavelengths may bound the particle size ranges. The estimates of mass concentration and particle sizes will be compared with in situ measurements made by other Army agencies.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0007, INVESTIGATION OF SOLAR-TERRESTRIAL EFFECTS ON ATMOSPHERIC ELECTRIC FIELDS IN ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP78-21712)

The Earth's fair weather electric field will be measured at South Pole and Vostok Stations in Antarctica for a period of two years. The electric field data will be used in conjunction with solar and geomagnetic data to investigate solar terrestrial effects associated with solar flares, solar magnetic sector boundaries, and transpolar magnetospheric convection electric fields, during the third year of this grant.

Logistics support is required for one person to visit Vostok and South Pole Stations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0008, SYNOPTIC STUDIES OF OCEANIC FRONTS

C.N. Mooers, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN098053)

To develop a synoptic capability for oceanic fronts.

To use real-time (e.g., satellite IR and visible imagery) information and climatology in a diagnostic model to estimate the velocity field in oceanic fronts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0009, SOIL CORRELATION AND DATING, WESTERN REGION

D.E. Marchand, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Western Environmental Geology, *345 Middlefield Rd., Menlo Park, California* 94025 (9540-02192)

STATES TO WHICH PROJECT PERTAINS: All western states, including Rocky Mountains and adjacent Great Plains.

We are describing, sampling, and analyzing soils formed on dated sequences of quaternary deposits in the western U.S.

region to obtain and interpret extensive quantitative data for these soils. The purpose of these studies is to determine how soil properties can be best used for correlation and dating of quaternary deposits and land surfaces. We will determine rates at which soil properties change with time and the effect of vegetational, climatic, and parent material factors on these rates. Our work will be coordinated with other projects within and outside of the Geological Survey that are involved in new or established techniques of Quaternary correlation and dating.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, REMOTE SENSING OF PARADOX BASIN
J.D. Friedman, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-02565)

STATES TO WHICH PROJECT PERTAINS: Utah, Colorado.

The objective of the Paradox Basin remote-sensing project is to acquire, process, and interpret geologically a variety of satellite and aircraft image products of the Paradox basin region in order to assess factors in the tectonic and geomorphologic environment which might significantly affect the quality of a nuclear-waste repository site without impairing the integrity of potential waste repository sites by investigatory drilling operations. Particular attention will be given to detecting and delineating previously unmapped structures, and evaluating age or time of last movement along faults. Geomorphic and structural factors giving evidence of movement within the salt diapirs or vertical changes in position of the water table will also be considered.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, ELECTRONIC LAB SUPPORT
C.M. Mitchell, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9780-01758)

STATE TO WHICH PROJECT PERTAINS: Colorado.

The objectives are to provide laboratory and field support for equipment which is used in the development and application of new techniques for assessment and evaluation of mineral resources. During this year, an LSI-11 minicomputer will be incorporated into the truck magnetometer system to provide for digital filtering and depth-to-basement computations while in the field. A second AMT system will be developed, adding a fifth channel and employing a different type of filter. Maintenance and field support will be supplied for other equipment.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0012, SOLAR WEATHER RELATIONSHIPS
S.G. Gathman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980045)

Improve the long-range weather forecasting ability of the Navy by investigating the effects of low intensity, spatially extending driving forces produced by solar variations on the global scale weather patterns.

Cause and effect correlations between measured solar x-rays and solar wind and various later-occurring global scale weather anomalies are studied in an event-by-event basis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0013, CONTINUOUS OPERATION OF THE GEORGIA TECH METEOR WIND RADAR
R.G. Roper, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (ATM78-11741)

This grant funds a program of research which continuously measures the winds at mesopause altitudes (80-100 km) above Atlanta (34 degrees N, 84 degrees W) using the established Georgia Tech Radio Meteor Wind Facility. Those measurements which have been made since August, 1974, have shown the necessity for continuous operation in order to observe the planetary wave portion of the dynamic spectrum, and to attempt to detail the synoptic meteorology of the mesopause level. Such data, in conjunction with that gathered by other members of the Global Radio Meteor Wind Studies Project, is essential to the production of global models of the circulation in the neighborhood of the mesopause, and in providing 'ground truth' for proposed measurement of mesopause dynamics from satellites. The determination of the dynamics of the mesopause is a key objective of the Middle Atmosphere Program of the Special Committee on Solar Terrestrial Physics, scheduled for the next decade.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0014, LAGRANGIAN CURRENTS MARSEN
J.N. Suhayda, Louisiana State University, Agricultural & Mechanical College, School of Engineering, Dept. of Civil Engineering, *University Station, Baton Rouge, Louisiana* 70803 (DN975547; N00014-79-C-0618)

Objective of experiment is to determine surface and near-surface Lagrangian current velocities in the southeastern part of the North Sea as part of the international Marsen experiment. The results will be used for studies of surface wave kinematics, of the interaction of surface waves and ambient currents, of wind-induced currents, and to provide sea-truth for the interpretation of remotely sensed sea surface data. In addition, remote sensing data obtained by synthetic aperture radar on the surf zone, are to be investigated for their potential to enchance the potential for better defining surf parameters.

Free-drifting drogues, the 'sails' of which are set to various pre-determined depths, are deployed and their movement is tracked for a period of one to four days by a triangulation from three radar stations on the islands of Sylt and Norderney and at Cuxhaven. The program was supported by an extensive array of other related measurements in the Marsen program. After the measurements, the results have to be analyzed. Data from other measurements will be included in this analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0015, THE ANALYSIS OF SIMPLE CLIMATIC MODELS USING CONTROL SYSTEM THEORY
R.G. Watts, Tulane University of Louisiana, School of Engineering, Dept. of Mechanical Engineering, *New Orleans, Louisiana* 70118 (ATM79-16332)

Methods of nonlinear systems analysis and automatic control theory, previously developed for engineering applications, will be adapted and applied to simplified climate models in order to study climatic variability and its prediction. The aims of the research are: (1) to define and understand the role that systems analysis can play in the analysis of climate models; and (2) to study a hierarchy of increasingly complex models in order to understand the roles of internal and external disturbances in causing climatic change. 'Internal' disturbances are those arising within the earth-ocean-atmosphere system, for example, changes in oceanic circulation; 'external' disturbances are those, such as changes in solar radiation, arising outside of the earth-ocean-atmosphere system.

Climatic variations on the order of a few years up to several thousand years will be investigated. Special attention will be paid to the critical role which the deep oceanic circulation may have in causing climatic changes. The effects of changes in the albedo and ice-cover of the Earth on climate will also be studied.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0016, 3D TROPO/STRATO MODEL
N. Szedak, Atmospheric & Environmental Research Inc., *872 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DF582170; F19628-78-C-0215)

AF function - environmental effects of Air Force systems operations in the stratosphere. Objective - to determine the effects of perturbations in the natural stratosphere-troposhere caused by the exhaust emissions from Air Force vehicle operations. How research contributes - provides the Air Force with information on the degree of environmental modifications by its systems operations which will prevent, by arbitrary decision, restrictions and delays on its missions.

The sulfur budget problem will be analyzed with both the compartmental model and an updated one-dimensional model. The atmospheric bromine problem will be re-evaluated in light of the interaction between bromine and chlorine oxides. A detailed two-dimensional stratospheric model will be developed which will couple ozone chemistry to the wind field and dynamics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, DESIGN A TACTICAL CONVERT CEILING AND WIND MEASURING SYSTEM

Unknown, Block Engineering Inc., *19 Blackstone St., Cambridge, Massachusetts* 02139 (DF259910; F19628-67-C-0203)

A tactical requirement exists (TAC letter 21 June 1966/ TAC P-1559-28 revised) for an infrared light unit and detector, having the covert capability of wind and cloud height measurements at night. The objective of this effort is to provide one prototype system for operational test and evaluation and to provide a military specification of the optimized system for a future limited type procurement. The wind measuring unit will consist of an IR light source (not more than 30 grams) attached to a 10-gram balloon, having sufficient intensity to be detected from a ground-based detector (accessory to a standard Air Force theodolite ml-247) when the balloon is at a slant range of 6,000 feet under cloudless conditions, or 3,500 feet with an intervening 500 foot cloud/fog layer of normal drop-size distribution. The unit will also have a day-light measurement capability. The ceiling height unit will be an IR light source capable of 3,500 foot measurements when used with the above described theodolite/ detector through a standard triangulation technique.

SUPPORTED BY U.S. Dept. of Defense, Geophysics Lab., Meteorology Div.

5.0018, ANALYZE DATA OF ROCKETS FLOWN INTO DISTURBED ATMOSPHERES

R.E. Hegblom, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Mathematics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF246300; F19628-77-C-0166)

AF function - communications, navigation, surveillance and detection. Deficiency - incomplete understanding of ionization and background infrared emissions in disturbed ionospheres. Research -rocket investigations of naturally disturbed ionospheres, such as in aurora. Rocket data analysis of flights flown into disturbed atmospheres. How research contributes - provides ability to predict radio wave propagation and infrared backgrounds resulting from ionospheric perturbations both naturally occurring and nuclear weapon induced.

Rockets will be flown into disturbed atmospheres for coordinated measurements of incoming energetic radiation, ionization, heating, composition and optical infrared emissions. Experiments include Gerdien condensors, impedance and particle counter probes as well as photometers, radiometers and mass spectrometers. The results of these investigations are important for the specification and characterization of physical processes, both cause and effect, that are dominant during atmospheric disturbances both natural and artificial.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, CLIMATOLOGICAL AND STATISTICAL ANALYSIS

J. Mettauer, Regis College, Undergraduate School, *235 Wellesley St., Weston, Massachusetts* 02193 (DF580580; F19628-78-C-0153)

AF function - design of aerospace systems. Deficiency - require meteorological and climatological data in greater detail and complexity for adequate design and aerospace operational doctrine. Objective - to perform mathematical and statistical studies on meteorological and climatological data. This includes developing statistical presentations that can be used for estimating the integrated effects of temperature, density and wind on aerospace vehicles, develop and test statistical models that support the utilization of weather-sensitive AF systems, and develop mathematical models that estimate the simultaneous occurrence of weather events at one or more geographical locations. How development contributes - describes the variability of atmospheric parameters in formats required in AF design and operation.

The principal investigator has extensive experience in statistical and probabilistic modeling of atmospheric phenomena. He will apply his expertise in mathematical and statistical theory along with computer techniques to the climatic record in order to develop and test the models mentioned in the objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, RADIO INTERFEROMETRIC STUDY OF SOLAR FINE-SCALE STRUCTURES

K.R. Lang, Tufts University, Medford Campus, School of Arts & Sciences, Dept. of Physics, *Medford, Massachusetts* 02155 (DF582610; F19628-79-C-0010)

AF function - communication and surveillance. Deficiency -capability of medium-range (1-5 day) prediction of operationally disruptive solar activity does not presently exist. Objective - to investigate the time-varying fine-scale structure of the microwave radiation from solar active regions by very high resolution radio interferometry. How research contributes - will provide a knowledge of flare precursor mechanisms needed to establish prediction techniques to forecast electromagnetic and energetic-particle emissions that disrupt HF communications, OTH radars, and satellite sensors.

Microwave observations (in brightness temperature and polarization of the time-varying fine-scale structure of very small sources in solar active regions will be made using two-element interferometers at NRAO or JPL and the aperture-synthesis network of the very large array (VLA) at Socorro, N.M. The greater radio-radiation detail made possible through the use of these very high resolution instruments will hopefully lead to greater knowledge of the flare triggering mechanisms present in very small sources. Any possible flare precursors will be evaluated for their importance as operational predictors of disruptive solar activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, CLIMATOLOGY OF MIDDLE ATMOSPHERE

A.E. Cole, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584310)

AF function - design and operation of aerospace vehicles. Deficiency - distributions and the time and space variations of the wind and the thermodynamic properties of the atmosphere for levels up to 100 km must be known in order to establish design criteria for aerospace systems. Objective - to develop improved presentations of the variations in the structure of the natural atmosphere between 30 and 100 km. How development contributes - a more detailed knowledge of the atmospheric structure below 100 km is important in targeting, design of propulsion and guidance systems and evaluation of aerospace systems.

Statistical and physical models of the atmosphere will be developed from temperatures and densities measured or derived from rocket and remote satellite observations for levels between 30 and 100 km. Appropriate radiosonde observations will be used at heights below 30 km. Time and space variations in the wind and thermodynamic properties of the atmosphere will be examined and modeled.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, BALLOON MEASUREMENTS OF SOLAR ULTRAVIOLET RADIATION IN THE STRATOSPHERE
L.A. Hall, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF244820)

AF function - environmental impact of high-altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy depostionn rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Balloon flights of a solar spectrometer will provide data on the solar spectrum in the range 2000-3000A, as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, IMAGE PROCESSING AND ENHANCEMENT
S.L. Keil, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584730)

AF function - communications, surveillance, detection, tracking. Deficiency - in order to accurately study satellites and to understand the basic mechanisms operating on the solar surface which give rise to solar-induced environmental disturbances, image degradation caused by turbulence in the Earth's atmosphere must be removed. Objective - we desire to apply image reconstruction and processing methods developed by AFGL/PHS to routinely observe satellites at high resolution, routinely obtain long time sequences of high resolution solar images, and to perform advance studies of large interferometric telsescope systems. How research contributes - improved satellite images will enable the Air Force to accurately determine the purpose and performance of Earth-orbital satellites. Improved solar images will enable us to directly study the origins of solar magnetic disturbances for the first time. New large interferometric telescopes promise even greater resolution increases - up to factors of 1000 over current resolution capabilities.

Under previously completed AFGL/PHS work units we have developed image reconstruction techniques to the point where they may now be used to make useful observations. Under this work unit the technique known as speckle interferometry will be used to routinely observe datellites. Speckle interferometry and active optics systems will be used to obtain greatly improved solar images. These images will be studied and analyzed with new image processing and array processing hardware. We will also investigate further image processing technique development. To investigate even greater increases in imaging through the atmosphere we will support contractor efforts to adapt new multiple mirror telescopes for interferometric image reconstruction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, NONLINEAR INVERSION ALGORITHM FOR SATELLITE-SENSED TEMPERATURE RETRIEVAL
J.I. King, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583090)

AF function - weather surveillance and forecasting, enhancement of probing techniques, weapons delivery. Deficiency - inability to exploit the full atmospheric sensing capability of defense meteorological satellite program (DMSP) over inaccessible or unfriendly territory. Objective - to develop data analysis and inversion techniques capable of extracting all the information regarding atmospheric structure inherent in the DMSP sounder data. How research contributes - nonlinear inversion accesses only valid atmospheric inferences by dealing solely with DMSP radiance data free from the contamination introduced by subjectively imposed constraints.

Nonlinear inversion has the attractive features of objectivity (no 'first-guess', prognosis, or climatological input is needed) and noise discrimination (data noise is inferred and isolated by the algorithm without smoothing requirements). The fast laplace transform (FLT) technique will be programmed for real-time inversion of synthesized radiance data. Following that, a scaled transform theory will be developed capable of incorporating empirical atmospheric transmittance into the inversion algorithm.

SUPPORTED BY U.S. Dept. of Defense, Geophysics Lab., Optical Physics Div.

5.0025, NORTHERN LATITUDE PLASMASPHERIC VARIABILITY
J.A. Klobuchar, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580870)

AF function - time delays in satellite navigation detection and tracking systems. Deficiency - the day-to-day variability of the ionosphere and the unknown contribution of the plasmasphere are not adequately represented by current models which have errors of up to 25 percent RMS. The plasmasphere can contribute greatly to this variability. Objective - determine the variability of plasmaspheric electron content in the northern latitudes, its correlation for pairs of stations and the extent to which it can be predicted or associated with other geophysical parameters. How research contributes - the contribution of the plasmasphere to total time delay produced on satellite radar and navigation systems can be large. The unknown behavior of the day-to-day variability of the total time delay is the greatest remaining error source in models of range error used by ADCOM in satellite detection radars and in the single frequency mode of the NAVSTAR/GPS satellite navigation system.

Using data already available from three northern mid-latitude stations, and additional data to be taken at a station near the peak of the equatorial anomaly, the day-to-day variability of the plasmaspheric electron content will be examined to determine the correlation between pairs of stations. Comparisons will also be made with other geophysical parameters to attempt to find the source of this variability from monthly average behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AURORAL IR SPECTRA
R. O'Neil, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584500)

AF function - infrared surveillance and detection systems. Deficiencies - lack of knowledge of infrared processes controlling the spectral nature of auroral emissions. Objective - to measure the intensity and spectral distribution of selected infrared emissions in an aurora as a function of particle deposition and altitude. How research contributes - this experiment contributes to the understanding of the intensity and spectral distribution of infrared auroral emissions against which conceptual infrared surveillance systems must function.

A rocket payload containing an interferometer and a co-aligned photometer will be launched into an IBC class II(positive) aurora from Andoya, Norway as part of the internationally coordinated Auroral Measurements Program, the energy budget campaign. The interferometer will measure auroral emission in the 2 to 7 micrometer range. The photometer will measure the n(positive)2 (first negative) 3914A emission as a monitor of the integrated incipent particle flux density. Analysis of the data will determine the production efficiencies for the excited states and of the photon yields for various atmospheric mechanisms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, DENSITY - TEMPERATURE MEASUREMENTS FOR ECLIPSE
C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582850)

AF function - radio HF communications (VLF through HF). Deficiency - D-region ionospheric processes effecting propagation and communication cause detrimental effects to AF systems. Objective - to provide the neutral density and temperatures at the time of the eclipse necessary to understand the fast ion chemistry in the D-region. How research contributes - the

eclipse provides a unique opportunity to study the electron, positive ion and negative ion response in the D-region due to sudden cut-off of solar EUV radiation. In order to test current ion-chemistry codes, the neutral atmosphere density and temperature must be defined.

A rocket payload carrying a 10-inch PZL falling sphere (vehicle provided by ASL/PSL) will be launched about 25 minutes prior to eclipse totality and a rocket payload carrying a 7-inch instrumented falling sphere will be launched about 25 minutes after totality. The density and temperature results will be analyzed to provide input to model calculations and ion-chemistry analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, ATMOSPHERIC COMPOSITION BY UV AND ELECTRON SPECTROSCOPY

R.A. Van Tassel, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581290)

AF function - vehicle tracking during flight and re-entry, trajectory prediction, communication systems. Deficiency - present atmospheric models predict only slight variability of the density of the upper atmosphere below 200 km, however, empirical data show this conclusion to be incorrect and observations indicate density changes as great as 50 percent in both space and time at altitudes between 120 and 200 km. This altitude region, important for Air Force operations, will be studied on a world-wide basis by density experiments aboard the DMSP satellites. The present work will support these experiments. Objective -in situ measurements with rockets of atmospheric parameters to provide correlative data for comparison with photometric data from DMSP satellites. How research contributes - provides direct, low altitude measurements of pertinent atmospheric properties as an aid in understanding the remote optical measurements made from DMSP satellites.

The goal of this effort is to measure at sounding rocket altitudes, various atmospheric parameters which may be used to verify the model development required for the interpretation of optical data acquired by sensors aboard DMSP satellites specifically for the purpose of remote density determination. Rocket measurements will be made of the photoelectron flux and differential energy distributions for energies between 0 and 100 electron volts, of the radiance of nitrogen airglow at 3371 angstroms, and of the density and composition of the upper atmosphere as established by solar ultraviolet photon absorption rates. All measurements will be made from a single rocket payload in the altitude range between 120 and 200 km.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, SEASAT PROGRAM - FURTHER SEASAT SAR MEASUREMENTS AND ANALYSIS

R.A. Schuchman, Environmental Research Inst. of Michigan, Radar & Optics Division, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (7-926; MO-A01-78-00-4322 MOD. #2)

OBJECTIVE: Investigate techniques for detection of oceanic current motion by measurement of the SAR azimuth Doppler frequency shift by separation from wave orbital and phase velocity effects. Results will be development of algorithms for current measurements using SAR, measurement accuracy estimates, and current velocity maps for the test area.

APPROACH: SEASAT SAR data collected over both the Columbia River, Oregon and the Gulf Stream will be utilized. Computer compatible tapes will be generated for data collected by the SEASAT SAR, the ERIM X-L SAR system, and the NOAA/SAIL real aperture SLAR system for analysis by NOAA and ERIM. Modulation scans as function of wave velocity and radar geometry, as well as Doppler measurements of wave crests and troughs for both range and azimuth traveling waves will be obtained using SEASAT SAR data obtained during GOASEX.

CURRENT PROGRESS: The Doppler shift of moving ocean scatterers relative to stationary scatterers has been measured using both aircraft X- and L-band, and SEASAT L-band SAR. Measurements to date indicate this Doppler method can predict current direction but the absolute magnitude is still under study. Results presented at the SEASAT Colloquium at Scripps Institution of Oceanography.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Earth Satellite Service

5.0030, MICROPHYSICAL AND CHEMICAL PROCESSES IN THE TROPOSPHERE

V.A. Mohnen, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Atmospheric Sciences, *1400 Washington Ave., Albany, New York* 12222 (ATM79-25435)

The research is divided into two areas: A) the chemistry of clouds; B) ion molecule interactions of atmospheric importance. There are two sub-projects: A) Develop a data base for the chemical composition of cloud water and correlate with measurements of relevant meteorological and other parameters such as precipitation quality, certain trace gas species (ozone, nitric acid, hydrogen peroxide, terpenes, etc.) and aerosols. The ground-based research efforts will be performed at the Whiteface Mountain Field Station of the Atmospheric Sciences Research Center (ASRC) (rural) precipitation chemistry center), while the airborne collection experiments are in cooperation with the National Center for Atmospheric Research (Dr. A. Lazrus, et al.) as part of the Acid Precipitation Experiment (APEX). Included in these efforts are: the testing and utilization of the airborne and ground-based ASRC cloud collection system for warm and cold clouds, and the ASRC liquid ion chromatograph: The results of the proposed measurements will aid considerably in shedding more light on the origin of acid rain in the northeastern United States and will serve as a basis for model validation. B) Develop a data base for understanding the evolution and chemical nature of stratospheric and tropospheric ions. From this, assess the potential of the Atmospheric Pressure Chemical Ionization Mass Spectrometer System (APCIMS) as an analytical tool for the detection of certain atmospheric trace gases at ultra low concentrations.

This grant continues work under Grant ATM-7681264, A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0031, STRATOSPHERIC DISCHARGES

R.E. Orville, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (DF580040; F19628-78-C-0007)

AF function - environmental impact statements of high altitude Air Force operations. Deficiency - current or anticipated AF operations in the stratosphere may deposit harmful materials and it is important to assess the potential impact of this in the context of the harmful substances deposited naturally by such things as thunderstorms. Objective - to perform an experimental study of glow discharges associated with lightning in thunderstorms but which occur above the storm in the stratosphere. How research contributes - this work would establish the existence and some of the characteristics of these discharges. Such discharges may be having a significant effect upon the chemistry of the stratosphere. They may in fact be generating large amounts of nox there, but comparatively little is known about the phenomenon at present. The work would also be important for future aircraft operations when they have the ability to fly over thunderstorms. This is because it is possible that they may experience or even initiate clear air stratospheric discharges. A third area of relevance is that of navigation, surveillance, and communication since these can be affected by electrical activity.

The experimental program will center around an optical approach involving still and CINE photographs as well as spectroscopic investigations using filters and multichannel recordings. A comparison of certain spectral lines will prove or disprove the existence of the clear air stratospheric discharges. Vehicles such as high altitude aircraft and balloons will allow de-

tection of the phenomenon from above the thunderstorms. Both ground based and airborne observations will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, INTERPRETATION OF MORSEX V ARCTIC ICE-PACK MEASUREMENTS

B. Gebhart, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *3435 Main St., Buffalo, New York* 14214 (DPP80-09250)

This is a two-year project to investigate the buoyancy driven movement of water at the sides and bottom surfaces of sea ice floes.

Freezing or melting of sea ice changes the local density of the sea water, and produces density differences which lead to currents or organized convection in the water. There currents transport heat and salt and in turn affect the rate of freezing or melting.

This project will use data obtained by the principal investigator during NORSEX (Norwegian Remote Sensing Experiment) V - a cruise to the vicinity of Svalbard organized by the Norwegian Intercontinental Shelf Institute using R/V Polarsirkelin. The objective of this project will be to develop a general model of ice floe transport dynamics which will relate freezing and melting rates to seasonal conditions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0033, COASTAL METEOROLOGY

G.S. Raynor, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973 (106358 TICNO; 000547)

This study is designed to obtain an understanding of meteorological processes in the coastal region that affect siting, operation, and safety of power-producing and related facilities located either offshore or near a coastline. The study involves climatological investigations, tracer experiments, wake-effects studies, mesoscale and micrometeorological observations, theoretical studies, and modeling programs. A major goal of the program is to develop a reliable system for describing diffusion conditions affecting releases from coastal or offshore sites and to predict them from measurable meteorological and surface parameters such as general synoptic situation, type of flow (sea-breeze or gradient), wind and temperature structure, sea-surface roughness, and coastal terrain. Meeting this goal involves an understanding of conditions in the transition region where over-ocean flow is modified by passage over land as well as over the water. Results of this program will include techniques for the prediction of over-ocean and coastal wind and temperature fields which not only transport and diffuse pollutants but are involved in air-sea interactions and oceanic processes. They will also include a rating of sites along the U.S. East and Gulf coasts in terms of onshore wind frequency, diffusion capacity, and severe weather prevalence.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0034, OCEANOGRAPHIC APPLICATIONS OF MAGSAT

R.D. Regan, Phoenix Corp., *1700 Old Meadow Rd., McLean, Virginia* 22101 (DN994453; N00014-79-C-0653)

Provide technical support to NORDA for comparative analysis of satellite, shipboard, and airborne geomagnetic data sets, assist in the statistical comparative analysis of the ship, air, and satellite data sets as they relate to crustal and tectonic studies of the Earth's lithosphere and in the preparation of a final report summarizing the applicability of satellite magnetic measurements to these studies.

(a) Development and implementation of computer programs to convert these data sets to image formats compatible with NORDA's I2S 101 computer, (b) development of a procedural manual for the analytical display of the converted data on I2S 101 computer, (c) development and implementation of an interactive computer program for three-dimensional modeling of magnetic source bodies utilizing the I2S 101 computer, and (d) development and implementation of plotting programs for display of satellite residual data sets by specified parameters (time, position, altitude, external field indices).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity

5.0035, TEST AND DEMONSTRATE AIRBORNE ELECTROMAGNETIC SYSTEM OVER KNOWN GEOTHERMAL RESOURCE AREAS

F. Frischknecht, U.S. Dept. of the Interior, Geological Survey, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

5.0036, LEWISTON-SHERBROOKE 2 DEGREES CUSMAP REMOTE SENSING

H.A. Pohn, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9790-02253)

STATES TO WHICH PROJECT PERTAINS: Maine, Vermont, New Hampshire.

The objectives of the remote sensing effort are: 1) The presentation and interpretation of regional terrane patterns which may not be obvious to geologists working at large scales in this area of extensive surficial cover; 2) Characterization and interpretation of morphologic features related to surficial deposits of potential economic value. The tangible contributions analysis of remote sensing data from which regional structure - particularly brittle structure - may be interpreted; development of a regional brittle structure pattern within which tectonic and metallogenic models may be related; identification of large structures or structural trends which may be field checked in other phases of the project.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0037, PLANETARY MINERALOGY

P. Toulmin, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9710-00954)

The project is concerned with mineralogical studies of extraterrestrial planetary bodies by theoretical and remote analytical methods. Principal emphasis is on the analysis of Martian surface materials by means of two instruments on the Viking Mars Landers: An X-ray fluorescence spectrometer for elemental analysis of surface samples, and gas chromatograph-mass spectrometer; the latter, in addition to its primary applications to the organic analysis of the Martian 'soil' and the analysis (by MS alone) of the Martian surface atmosphere, has provided useful data on volatile inorganic constituents of the Martian surface. Active operation of the X-ray fluorescence spectrometers on Mars has ended, but laboratory analysis of analogue materials on flight-like instrumentation continues.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0038, DROUGHT AND DESERTIFICATION INDICATORS FROM LANDSAT IMAGERY

C.J. Robinove, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092

Objectives are to test a method for measuring change in albedo of arid lands using LANDSAT digital images and to determine the capability of LANDSAT for monitoring areas of changing land conditions. Tests will be conducted in the western United States and possibly in Mexico. The objective is to create an effective monitoring system at a reasonable cost for the arid and semi-arid regions of the World.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0039, RADIATION EFFECTS OF CLOUDS AND AEROSOLS
N.S. Laulainen, U.S. Dept. of Energy, Battelle Pacific Northwest Lab., *P.O. Box 999, Richland, Washington* 99352 (106156 TICNO; 003058)

This project emphasizes simultaneous measurements of aerosol physical, chemical and radiative properties and of the solar radiation field at various levels within the urban planetary boundary layer to determine the relative properties of atmospheric, energy-related (AER) aerosols, clouds and the interactions between clouds and AER aerosols which affect the radiative properties of cloud/aerosol systems. This study expects to use data collected from surface and aircraft observations during clear and cloudy days, over various surface albedos and for various aerosol loading conditions.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0040, EXPERIMENTS IN SMALL-SCALE SURFACE MODIFICATION
C.R. Stearns, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM78-08437)

This project will conduct small-scale (2000 sq. m less) airmass modification experiments. The purpose is to obtain surface aerodynamic and insolation properties related to the surface structure (for example, surface roughness, albedo, and heat transfer coefficient) so that, given relatively simple meteorological measurements or assumptions, models can be constructed to interrelate the wind stress on and the sensible heat flux from the surface. The gust frequency distribution will be determined as a function of surface roughness. The horizontal pressure gradient around the obstacle field will be measured.

The field experiments will be conducted on the ice of Lake Mendota, Wisconsin, in two major categories: (a) momentum transfer studies using roughness modification by arrays of diverse types of obstacles (baskets, barrels, or small conifer trees) of various sizes and in a variety of patterns, (b) combined heat transfer and momentum transfer experiments using albedo differences (for example, black versus white baskets) in the presence of sufficiently strong insolation.

In addition, previously collected turbulence data will be analyzed about a change in surface roughness.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0041, STRATOSPHERIC RESIDENCE TIMES FROM CONTRAIL OBSERVATIONS BY SATELLITE
N. Rosenberg, Tel Aviv University, *155 Herzl St., Tel Aviv, Israel* (DF056130; F49620-79-C-0180)

AF function - all aircraft and rockets which operate in the stratosphere (approximately 10 to 50 kilometers altitude) deposit water and other combustion products which might adversely effect the natural composition and chemical balance of that region. Recently, there has been increased concern over the effects upon the stratospheric ozone which absorbs and protects the earth's biosphere from solar ultraviolet radiation. The Air Force is required to submit environmental impact assessment statements on all weapons systems which operate in the stratosphere. The public furor over the SST and B-1 was partially due to the concern over the possibility of zone depletion by engine exhaust gases. Deficiency - the turbulent mixing and larger scale transport of the natural and man-made chemical species are important factors in modeling of the perturbed stratosphere. Several programs are underway to measure in-situ the concentrations and turbidity. However, little is known of regional values and few statistical models exist for total impact assessments. Objective - this research will investigate the possibility of using LANDSAT satellite images of aircraft contrails to determine stratospheric turbulence coefficients and evaluate the feasibility of using such data to develop a statistical model of eddy diffusivities and stratospheric residence times.

The contractor will search the LANDSAT archives for photos of aircraft contrails, estimate the number of photos required to locate sufficient such images for a second phase study, analyze the best six images located, and by digital analysis, determine radial growth characteristics, the altitude and relationship with known or estimated atmospheric parameters, and derive the eddy diffusivity for the six sample cases. The contractors results will be used to determine the feasibility of the follow-on study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, SUBJECTIVE PERFORMANCE MEASUREMENT
E.L. Martin, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223710)

1. To develop a pilot performance measurement system and methodology for airborne application. 2. To develop an efficient and effective observer training program.

A series of at least three studies will be conducted in order to accomplish objectives. Candidate task measurement formats for selected tasks will be developed analytically. The prerecorded demonstration capability of the ASPT will be used to provide controlled measurement observation set for data collection. IPS will serve as subjects. Task formats, observation intervals, and training procedures will be selected so as to optimize reliability and validity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, AIRCREW PERFORMANCE MEASUREMENT RESEARCH
D. Vreuls, Vreuls Research Corp., *Thousand Oaks, California* (DF058320; F49620-80-C-0058)

AF function - given the increasing degree of complexity involved in the appropriate operation of modern combat aircraft, it is essential that the Air Force develop more effective aircrew training procedures. In order to make decisions about the relative effectiveness of different training techniques, it is necessary to have accurate, objective and convenient measures of aircrew performance. Deficiency - the science of objective aircrew performance measurement is rapidly developing in the Air Force, Army, and Navy R&D communities in conjunction with new training devices, especially operational flight trainers and full mission simulators. At this time this development is roughly in three parallel and separate tracks, one for each service, which does not take advantage of advances made within the community. While some measures will be unique to a specific service's aircraft and mission, other measures will share a commonality between services. At this time, our limited knowledge of performance measurement techniques does not allow rigorous standardization across efforts. Objective - the objective of this research will be to study aircrew performance measurement efforts within the Air Force, Army, and Navy R&D communities and develop a framework for establishing standards of how performance measurements should be made and reported. How research contributes - this research will determine if the three services can have complementary programs in aircrew performance measurement and specify in which areas commonalities can be maximized by establishing standards for measuring and reporting dependent measures in empirical research.

The principal investigator will examine ongoing programs in performance measures development among the three services as well as the current technologies which other R&D communities use to standardize or calibrate their measurements. Several candidate measures will be selected along a range of complexity, and procedures for isolating the common elements will be developed. Standards will be attempted for these measures and, if successful, procedures which will permit the work to be expanded to other measures will be developed. This effort will be conducted under the supervision of a tri-service working group of scientists from the training R&D community which will

guide the principal investigator in his selection of measures and evaluate the resulting standardization efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0003, PHYSIOLOGICAL AND PERFORMANCE EFFECTS OF SHIP MOTION ON CREW MEMBERS
C.L. Ewing, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Bioengineering Sciences Dept., *New Orleans, Louisiana* 70189 (DN141828)

To determine the physiological and performance effects of ship motion on crew members as induced by existing and advance surface vessels and/or aircraft.

Measured ship motion and mathematical simulations of surface platforms will be reproduced in the laboratory then used to stimulate both instrumented human volunteers and large primate subjects on whom physiological and performance decrements as well as pathological effects will be measured. The data will be used to develop ride quality criteria, the medical basis of crew selection criteria for vehicles and in determining effects of the motions on personnel. Human and primate analog tolerance to various durations and intensities of the measured motion will be determined in various postural modes as a function of performance and physiological decrement, in relation to time duration, g and frequency. Enlisted volunteers are recruited from ntc, orlando fl. primates used are macaca mulatta, papio cynocephalus, and pan troglodytes.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0004, HIGH Q WINDBLAST FORCES ON MAN
P. Payne, Payne Inc., *Annapolis, Maryland* (DF323000; F33615-77-C-0523)

The forces acting on the ejecting crewman entering the windstream during emergency escape are the second most frequent major cause of all injuries experienced during ejection. Injuries attributed to windblast flail are encountered in 5.6 to 6.9 percent of all survived ejections, while 54 percent of ejections in the 450 to 600 KEAS range result in major injuries or fatalities. As the performance envelope of advanced aircraft systems is expanded, windblast injuries will probably become more common. With the advent of the newer bubble canopies, windblast forces are encountered before the crewman is clear of the aircraft. The data that have been collected on crewman during emergency escape have been limited to that portion of the escape sequence in which the crewman was exposed to free-stream conditions. One-ninth scale model wind tunnel tests of the F-16 aircraft have indicated that the environment within the cockpit before entry into the high-speed windstream is potentially hazardous. The aerodynamic forces are increasing in magnitude and the turbulence levels encountered may seriously compromise the crewman's chance of survival before rescue. The objectives of this program are to provide measurements of the aerodynamic forces that are encountered during the initial and transitory phases in the turbulence about the cockpit in order that effective protection countermeasures can be developed.

The program will combine an analytical effort with a wind tunnel scale study. The model will be used to collect pressure and force data needed to quantify inertial and aerodynamic forces acting on the ejecting crewman to cause injury and the development of requirements for the design of personnel protection systems. The analytical effort will allow for the analysis of the wind tunnel data as well as exploring the use of various testing facilities and techniques for windblast research.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0005, DYNAMIC RESPONSE OF HUMAN HEAD AND NECK TO IMPACT ACCELERATION
R. Thorpe, Q E I Inc., *119 the Great Rd., Bedford, Massachusetts* 01730 (DN875201; N00014-78-C-0121)

The design of safety devices for pilots of fixed-wing and rotary-wing aircraft is dependent on our understanding of the response of the human body to extreme acceleration and impact forces. This research will assist in establishing this dynamic response of the human body to acceleration and impact forces. Additionally, this work will investigate ship motion and its effect on man physiologically, inertially and behaviorally.

The principal investigator will reduce and analyze the large amount of data on 3-D head-neck and torso response to impact acceleration that is being collected at the Naval Aerospace Medical Research Laboratory, Detachment, New Orleans. Inertial sensor data, physiological data and sled data will be digitized and normalized to standard conditions and analysis performed on this data for application in dynamic response models. The principal investigator will also participate in experimental protocol planning and formation to provide analytical rationale for experimental procedures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0006, IMPACT RESEARCH FACILITIES OPERATION AND MAINTENANCE
H. Boedeker, Dynalectron Corp., *Holloman Air Force Base, New Mexico* 88330 (DF325430; F33615-79-C-0523)

The objective of this contract effort is to provide efficient and effective maintenance, alteration and operational support efforts so that the maximum utilization of the impact facilities of the Aerospace Medical Research Laboratory (AMRL) will be achieved. These facilities include the impulse accelerator, the low-G launch system, the hydraulic decelerator, the vertical deceleration tower, the square wave impact simulator, the monteray impact facility, the vertical HYGE, the ASD helmet test device, the automatic body positioning and restraint device, the transducer calibration facility, the data acquisition system, and the automatic data processing and control system. No research or development work will be accomplished as part of this effort.

The contractural effort provides technical services required to provide the facilities' operations to support AMRL experimental research requirements and R&D test and evaluation requirements of the aeronautical systems division. Test support is also provided to other government agencies such as the Department of Transportation under interagency agreements. To accomplish the required objectives, tests are conducted on various impact simulators to produce acceleration profiles of various shapes, levels and durations. Data collected during these tests are processed using on-site equipment and Aeronautical Systems Division computer facilities.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0007, TRAINING REQUIREMENTS ANALYSIS FOR TACTICAL DOMAINS
G.A. Klein, Klein Associates, *Yellow Springs, Ohio* (DF055310; F49620-79-C-0179)

AF function - this research supports Air Force programs in flight and technical training, especially those that deal with training complex skills. Deficiency - basic skill acquisition such as that found in novice level training programs has been extensively studied and documented. It has often been the target of instructional systems development (ISD) analysis. Complex skill acquisition, on the other hand, is the least studied yet most costly type of training. Several questions exist regarding how to organize and structure training programs in this area, especially for skill categories involving tactical operations. Objective - the objective of this research is to formulate methods and techniques that can be used for defining training requirements in the areas of tactics, decision making, and critical combat skills. How research contributes - this research will determine if new ways of stating training requirements can impact instructional systems design for complex skill acquisition.

This research will study the differences between rule-following learning and situationally sensitive learning at high levels of proficiency (the expert operator such as an accomplished fighter pilot). Interviews with personnel who work in situations requiring analogical reasoning will be conducted to assess the difference between their types of problem solving tasks and environments where deductive or inductive reasoning is more ef-

fective. Descriptive models of how analogical reasoning is used in problem-solving and decision-making situations will be constructed, and an attempt will be made to develop prescriptive models for training analogical reasoning for certain complex skill categories.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, MODELING OF HUMAN RESPONSE TO AERODYNAMIC FORCE

T.R. Gardner, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322950)

Exposure to a high-speed wind stream during ejection from an aircraft poses a serious threat to the safety of the ejectee. Methods are needed for assessing the extent of this hazard under various flight conditions and for different ejection modes and systems. This program seeks to provide an analytic methodology for predicting human body response to wind forces encountered during ejection from aircraft. It will deal with both experimentally and theoretically specified aerodynamic environments in providing body response predictions.

The main modeling emphasis will be placed on the development and refinement of the articulated total body (ATB) model and the preparation both from separate experimental programs and by theoretical means of quantitative specification of the aerodynamic environment surrounding the human body during ejection. The model will be applied to predict body limb motion resulting from the prescribed aerodynamic environments. It will also provide predictions of stresses and torques within the major long-bone joints and estimates of probable injury resulting from limb excursions outside of normal ranges of motion.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0009, EFFECTS OF AF PROPELLANTS AND CHEMICALS ON METABOLIC MECHANISMS

M.E. George, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320700)

The purpose of this basic research is to identify and define those underlying physiological and biochemical mechanisms associated with the systemic toxicity of chemicals and material.

Studies on the effects of toxic, carcinogenic and mutagenic chemicals of special Air Force interest and application on metabolic pathways and mechanisms of action require use of radioactive tracers, gas and liquid chromatography coupled with mass spectrometry, and electron microscopic evaluation of cellular and subcelluar changes. The ultimate application of these fundamental mechanisms is to facilitate extrapolation of animal data to humans by selecting the most appropriate laboratory animal species which handles the compound similar to the metabolic pathways of man.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Toxic Hazards Div.

6.0010, VCASS LABORATORY SYSTEMS DESIGN/INTEGRATION

D.F. Kocian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321150)

To perform the systems analysis and design of the overall visually-coupled airborne systems simulator (VCASS), including the visually-coupled systems (VCS) components (helmet-mounted sight/helmet-mounted display), scene/graphics generators, and crew station, computational, software data base subsystems. To specify the configuration of VCS and scene generation components to be developed on contract. To integrate these components into a laboratory systems demonstration of the VCASS concept. The ultimate product of this program will be an extremely cost-effective, high fidelity visual scene simulation capability to be utilized for engineering design as well as training applications. This effort supports AFSC development goals TC-2, TC-4, TC-5, MS-4, and TN-1.

The overall VCASS effort will exploit the unique capabilities of the visually-coupled system (helmet-mounted sight/display) technology in order to provide a self-contained ground/airborne man-in-the-loop visual display scene simulator for performing man-machine interface design and engineering of cockpit control/display subsystems. Initially, an interim laboratory demonstration capability will be developed by integrating existing helmet-mounted sight and display components into a cockpit mockup with an interface to a programmable symbol generator. A demonstration will then be performed to show the conceptual use of the VCS as a hemispherical headup display. Psychophysical studies will be conducted to determine the critical VCASS design factors such as the required instantaneous field-of-view of the helmet-mounted display, display-update rate, angular resolution/update rate of the helmet-mounted sight and trade-off between monocular versus binocular display viewing. As a result of these findings, advanced VCS components will be specified and developed through separate contractual efforts. Simultaneously, a comprehensive systems analysis and system design will be performed for developing an advanced laboratory demonstration of the VCASS concept.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0011, TRANSMISSIBILITY CHARACTERISTICS OF THE PRIMATE SPINAL COLUMN

A.R. Slonim, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324110)

To determine the extent and characteristics of transmissibility of motion up the spinal column of the rhesus monkey and baboon. This effort will examine also the nature (e.g., phase change) of the response of the anterior and posterior portions of the spinal column. These data should provide some insight into the transmissibility of vibration in the spinal column of man, with the ultimate objective of developing a model for predicting vibrational effects on both primate and human spinal columns, as well as developing criteria and protective measures for the safety of crewmen in aerospace operations.

Primates will be surgically prepared with implanted accelerometers at different locations on the spinal column and then exposed to vibrations of low frequency (below 100 Hz). A series of four experiments will be conducted over a period of one year. The first experiment will evaluate the effect of vibration on rhesus monkeys with two implanted accelerometers, one at an upper thoracic level and the other attached to the sacrum. A second series of experiments will utilize baboons instead of rhesus monkeys. The third group will add a third accelerometer on the baboon at the lower thoracic level. The latter will be on the posterior column, while the upper thoracic accelerometer will be on the anterior column. The first three series will utilize three primates each. The fourth series will utilize up to 7 baboons in which the intervertebral discs have been removed at one or more levels to gain further insight into the mechanics of transmissibility of motion through the spinal column. In all experiments, an attempt will be made to correlate the response resonances observed with various physiological variables and later with resonances predicted from mathematical models of transmissibility.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0012, BIOTECHNOLOGY FACTORS IN SURVIVABILITY FIELD TESTING

G.J. Valentino, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF326110)

The objective of this fiscal four-year effort is multidimensional and includes several biotechnology-based issues heretofore not appropriately quantified in previously conducted field/flight tests of threat air defense systems. During the period FY80 through FY82 field data will be collected in two major areas - (1) photographic coverage of airframes, in flight, under

various conditions of altitude, offset, and illumination, and (2) tracking, prediction, and mode data from a human operator-controlled air defense system. The photographic record will be analysed, post-test at AMRL, and the empirical data will be compared with predictions from an AMRL in-house ground-to-air visual target detection model, the time-series air defense systems data will also be used for comparison and verification of existing AMRL AAA and SAM simulations. During FY82 and FY83 it is anticipated that a multiple system supervisory control field experiment may be conducted.

Specific details are classified and are available directly from AMRL/HEF (attn. - Capt. Valentino), WPAFB, OH 45433.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0013, USE OF THE C-5 A/C GROUND PROCESS SYSTEM FOR PROTOTYPING AUTOMATED MAINTENANCE SYSTEMS APPLICATIONS (AMS TEST PROGRAM)

R.C. Guy, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF228320)

To modify the ground processing system (GPS), an advanced maintenance management system unique to C-5 aircraft, to incorporate twenty-two new maintenance management concepts, primarily in automation/distribution of existing maintenance forms and automated parts ordering. The changes will be incorporated incrementally into the GPS. An evaluation will be performed to determine the effectiveness of these changes in reducing administrative workloads, increasing visibility of management information and increasing overall operational effectiveness. Additionally, the modified system will be compared against a non-GPS maintenance system to enable evaluaton for Air Force-wide application. The specific objective of AFHRL's participation is to evaluate these concepts from a human factors standpoint (e.g., ease of use, confidence in system, training requirements) and to provide consultation in the design and execution of the overall evaluation.

New concepts will be implemented incrementally into the basic GPS and evaluated on the basis of operational impact and human factors. AFHRL will concentrate on the human factors investigation, to be accomplished by - (1) assisting in task analysis, (2) identifying human factors evaluation areas, (3) developing job tests and data collection forms, (4) monitoring data collection, (5) analyzing human factors data, and (6) reporting findings. Manpower engineering teams will be the primary data collectors for both the human factors data, and the operational system evaluation data. To insure a valid assessment of change impact (resulting from automation), to be projected for other GPS and non-GPS applications, it is necessary to measure the same tasks in a similar but non-GPS system. The McGuire AFB, C-141 maintenance organization has been selected for this purpose. This effort will begin with evaluation of present system. Analysis and development of the proposed system will be accomplished as implemented by MAC. Detailed milestones can not be specified at this time. They will be specified as the effort progresses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0014, STRENGTH WITHIN THE RESEARCH ENVELOPE

L.L. Laubach, Webb Associates Inc., *Old Rte. 68 S., Box 308, Yellow Springs, Ohio* 45387 (DF316250; F33615-73-C-4104)

The ultimate objective of this research is to provide engineering-anthropometry data for the design of cockpits (or other manned workstations), specifically for the selection of controls, the arrangement of controls, and the operation of controls, for maximum efficiency under normal and emergency conditions. Such data are needed for USAF design handbooks for normal controls and for the evaluation of proposed emergency controls. The specific objective is to measure, in a systematic and consistent manner, the magnitudes of forces and torques that a group of subjects representative of USAF flying personnel, can exert within the total reach envelope.

Using AMRL/HEA's Hercules testing facility, the voluntary muscular strength (force or torque) shall be measured as applied with the hand or the foot to transducers representing unspecified A/C controls. The data points must unify previous piece-meal results and establish a definition 'atlas of strength' interpretable by designers and evaluators of A/C controls. They must be expressed in terms suitable for incorporation in the computerized biomechanical man-model COMBIMAN.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0015, GENETIC BASIS OF CRESOL BIODEGRADATION IN BACTERIA

H.D. Cobb, Trinity University, Graduate School, Dept. of Biology, *715 Stadium Dr., San Antonio, Texas* 78212 (DF041200; F49620-79-C-0192)

AF function - the Air Force uses large quantities of carbon-removing and paint-stripping compounds (ortho-dichlorobenzene and cresol), particularly at aircraft engine overhaul facilities, thereby concentrating the problem of degradation and disposal so as not to interfere with many forms of aquatic life due to the toxicity of these disposal products. Investigators will be concerned with the examination of basic molecular factors involved in cresol degradation. Deficiency -no satisfactory substitute compounds are available and no effective degradation or detoxifying process exists. Objective - the long-range goal of this research effort would be to use the information gained from these proposed studies on cellular molecular organization to develop bacterial strains with greater metabolic stability. The achievement of this goal could greatly enhance the productivity of a waste-treatment facility using these bacteria to degrade cresylic acid waste, how research contributes - this research will provide for the more efficient degradation of Air Force paint-stripping wastes and will therefore support the Air Force commitment to protect the environment.

This research will attempt to establish the basic structural elements responsible for the metabolism of ortho-dichlorobenzene and cresol by select bacteria and to determine the metabolic stability of this capability. Specific attempts will be made to determine more precisely which fundamental elements are responsible for cresol metabolism. A physio-chemical characterization of the genes responsible for cresol degradation will be done using electrophoresis and ultracentrifugation. Transformation studies will be conducted to determine the efficiency of producing a strain of bacteria with a greater capability for cresol degradation. Restriction endonucleases will be employed to transmit DNA between bacterial strains and incorporate this genetic material in more viable receptor strains.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0016, FEASIBILITY EVALUATION OF SIX-MAN OPEN LOOP OXYGEN GENERATION SYSTEMS (OLOGS)

L.J. Luskus, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322240)

To test for human compatibility for fluomine on-board oxygen generating system.

Flight prototype fluomine oxygen generator systems will be tested for contaminant off-gassing and human physiologic compatibility under simulated flight profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0017, OPTIMAL SINGLE LEAD EXERCISE ELECTROCARDIOGRAPHIC LEAD SYSTEM FOR IMMEDIATE RISK FUNCTION EVALUATION IN THE FIELD.

R.A. Wolthuis, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321630)

Current criteria for interpreting the treadmill test ECG were developed on and for symptomatic patient populations, these criteria do not work well in an asymptomatic USAF patient population, i.e., specificity is too low. This work unit is designed to evaluate different ECG leads and ECG measurements in an effort to define improved ECG interpretive criteria.

Multiple lead ECG data recorded on previous treadmill tests will be digitized, and selected digital ECG data will be averaged. Multiple measurements from each averaged ECG beat will serve as a basis for all subsequent analysis. The data bases will be divided into three groups -those with known coronary artery disease (CAD), those with a positive treadmill test but free of CAD, and a group at low risk for having CAD but without coronary angiography. Multivariant, discriminate analysis techniques will be used to ferret out the most important protocol conditions, ECG leads, and ECG measurements for discriminating between those with and those without CAD.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0018, CONDUCT FIELD VALIDATION OF NOISEMAP
P. Oncley, Man Acoustics & Noise Inc., *Seattle, Washington* 98103 (DF324650; F33615-79-C-0513)

NOISEMAP is the computerized noise prediction procedure that forms the cornerstone of the USAF air installation compatible use zone (AICUZ) program. The AICUZ program is used by the Air Force to beddown new weapons systems, select facility sites, evaluate existing operations and determine the land use compatibilities of all USAF bases with the neighboring communities. The objective of this contract is to further assess through long-term field measurements the overall ability of NOISEMAP to predict the yearly averaged noise environments produced by aircraft operations for the wide variety of missions and airbase locations within the Air Force as a whole. In cases of extreme controversy or litigation over environmental assessments for AF operations, these long-term field measurements will provide further evidence of the ability of NOISEMAP to predict the noise environments from AF operations.

This contract is to conduct long-term field measurements of total noise exposure at several locations around one or two USAF bases and compare these measured values with those predicted by noisemap. This effort will be accomplished as follows: (1) The contractor shall develop a written plan delineating the exact number, location and schedule of rationale for each. (2) This plan will be submitted to AMRL for review and final written approval before any measurements are made. (3) The contractor will conduct the long-term measurements of total noise exposure and analyze the field data in accordance with the approved plan. (4) The contractor will submit a final report presenting the acquired data, comparisons with the NOISEMAP-predicted values and final conclusions about NOISEMAP's overall effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL SIMULATION OF SPACECRAFT CHARGING PHENOMENA
J.G. Laframboise, York University, *Toronto, Ontario, Canada* (DF043460; AFOSR-76-2962)

AF function - the operation of USAF and of many other geostationary satellites has been degraded seriously by electrical anomalies resulting from the interaction of these spacecraft with their space equipment. Deficiency - reliable predictions are required of the effects of electrical discharges caused by differential charging of spacecraft surfaces to large voltages for any given spacecraft configuration. Objective - a numerical model is to be developed to simulate the plasma sheath surrounding a spacecraft. Contribution - the numerical simulation of the plasma sheath surrounding a spacecraft is essential for understanding phenomena produced by the space environment and for evaluating methods of correcting any damaging effects.

Work will be completed on a two-dimensional numerical simulation of the plasma sheath surrounding a spacecraft. Distributions of particle velocity, of sheath and surface electrical potentials for existing and proposed spacecraft will be calculated. Theoretical predictions applicable to spacecraft charging situations will be obtained. The effects of the choice and location of surface material, rotation relative to the sun, finite spacecraft length and time-dependent ambient particle distributions are to be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL STUDIES OF INHOMOGENEOUS ELECTRONIC SYSTEMS IN SOLIDS
H.B. Shore, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Physics, *5402 College Ave., San Diego, California* 92115 (DMR79-20813)

Theoretical investigations in solid-state physics previously supported by NSF grant DMR 77-11532 will be continued and extended in new directions. The density functional method will be applied to inhomogeneous electron-hole systems in semiconductors. The properties of bound and unbound multiexciton complexes and small electron-hole drops will be calculated using an atomic-like 'shell model' and compared with experiments on work functions, spectral properties, and nucleation properties of small complexes. Investigations will be conducted on the character of collective excitations such as plasmons and capillary modes in small complexes. Density functional theory will be used to determine the ground-state energy of clusters of impurities in semiconductors, in order to gain insight into the importance of clustering in impurity band information. In addition, the density functional method will be applied to problems in electron gas theory. Previous calculations on Wigner crystallization will be extended and applied to two dimensions. Similar methods will be used to investigate the onset of charge-density waves in a jellium model. Calculations on the metal-insulator (Mott) transition will be performed for a model system consisting of a lattice of point charges in an electron background. These calculations will be repeated for alkali metal lattices. Particular attention will be paid to the problem of electron self-interaction in limiting the validity of the density functional method.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, ELECTRON TRANSPORT IN ULTRA-THIN HETEROJUNCTIONS
P.D. Depkus, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DN875608; N00014-78-C-0711)

Advancing the capability of Navy electronics systems required understanding of the properties of newly developed materials and their application to new electron device geometries. Ultra-thin heterojunctions in gallium arsenide and gallium aluminum arsenide can now be fabricated and their electronic transport properties must be investigated to verify their device potential.

Thin heterojunction devices will be fabricated by the metal-organic chemical vapor deposition (MO-CVD) technique. 50 to 1000 angstrom layers of gallium arsenide will be sandwiched between high resistivity gallium aluminum arsenide layers with abrupt change in composition at the junctions. Electron transport measurements will be made on the properties of the device for current flow parallel and perpendicular to the junctions. These will include, C-V, I-V, DC conductance and Hall voltage measurements, in order to determine carrier concentration, mobility, and resistivity as a function of temperature, doping concentration, difference in bandgap between the two materials, and the layer thickness. Because of the thinness of the GaAs layer, carriers are quantized in the direction perpendicular to the junctions. The device properties will be investigated in

terms of this quasi-two-dimensional density of states and the energies of the resulting subbands in this quantum well.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0003, KINETICS AND STRUCTURE OF EXCITED STATES
T.F. Gallagher, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF039030; F49620-79-C-0212)

AF function - research objective 6.3, electromagnetic weaponry. Opportunity - the achievement of efficient, high-power visible lasers will depend critically on knowledge of those processes that influence the excited states of the lasing medium. Objective - to make measurements on excited electronic states of atoms and molecules. Contribution - information on radiative decay, collision quenching, energy transfer, etc. Will be useful in development of visible lasers.

A study is being made of electronic energy transfer between highly excited states of an alkali atom and other atoms, such as Hg or another alkali. The transfer process is being examined as the initial excited stages are varied through the resonance region. Measurements are being made of energy transfer rates between excited states of alkali atoms and vibrational states of simple diatomic molecules, such as NO, CO, N2, and O2.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, PLASMA CONFINEMENT THEORY AND EXPERIMENT PLASMA RESEARCH - INTERIM 2-1
J.E. Dawson, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (EY-76-C-03-0010-026)

SUPPORTED BY U.S. Dept. of Energy

8.0005, ENERGY TRANSFER IN CHEMICALLY REACTING SYSTEMS AND IN SURFACE CHARACTERIZATION
D.O. Harris, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DF046710; AFOSR-77-3138)

AF function - increased capabilities in remote sensing, communication, and several other areas depend on developments in laser technology and surface characterization. Opportunity - chemical lasers indicate a high probability of fulfilling these needs through their properties of different wavelengths, high power, high operating efficiency and lower weight. Objective - perform detailed studies of optically pumped metal excimers including high resolution spectroscopy. Determine effects of well-characterized solid surface interfaces on chemical reactions and on excited states of small molecules.

Obtain improved molecular constants, radiative lifetimes and quenching cross-sections for electronically excited molecules including Ca2. Presently Ca2 is produced in a stainless steel heat-pipe oven which can reach temperatures as high as 1100 degrees C, corresponding to a calcium vapor pressure of about 10 TORR. Using alumina (Al2O3) a new heat-pipe oven capable of reaching 1600 degrees C will be developed which will allow calcium vapor pressures to one atmosphere. The higher operating temperature also will allow the investigation of other molecules such as Cu2 which are unattainable at lower temperatures. Using laser photoluminescence and high resolution spectroscopy, other molecules such as Rb2, Ba2, Mg2 and Sr2 will be investigated as potential optically pumped lasers. An ultra-high vacuum system will be assembled and aluminum atom reactions will be investigated in rare gas matrices near aluminum and aluminum oxide surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, RESONANCE AND RELATED STUDIES IN CONDENSED MAGNETIC SYSTEMS
V. Jaccarino, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR77-20185)

Resonance and related techniques will be used to study new problems at high temperatures (e.g., effects of fast-relaxing impurities on the molten state EPR) and to embark on a systematic investigation of the magnetic dilution problem. The latter will involve temperature and concentration-dependent studies of the variation of the antiferromagnetic-spin flop phase boundary, the parallel and perpendicular susceptibility, antiferromagnetic resonance (AFMR) linewidth, the parallel-pumping threshold, the Mn55 NMR linewidth, the ordering temperature and the exchange enhancement of the paramagnetic susceptibility in the system Mn1-xZnxF2. Further work on the magnetic polaritons and the localized mode problem in the far infrared will be carried out along with complementary impurity NMR studies. This work should bring a level of understanding to the dilute and mixed-system problems comparable to that which exists for the perfect magnetic materials.

This is a continuation of research supported under DMR7503847; first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, DEVELOPMENT OF A HEAVY MULTICHARGED PARTICLE DETECTION METHOD FOR LONG DURATION SPACE MISSIONS
E.V. Benton, University of San Francisco, School of Science, Dept. of Physics, *2130 Fulton, San Francisco, California* 94117 (DF160270; F29601-70-C-0077)

An advanced heavy-multicharged particle detection method will be developed for use on space missions having durations in excess of 20 days. A considerable amount of research will be required on the basic physics of the interaction of heavy-charged particles in matter as well as a 28-day exposure of the detectors to the radiation environment which will be encountered by the Apollo Applications Space Station.

The use of laser diagnostic techniques to obtain details of the ion distribution function in the pinch stage of the plasma focus including this information in computer codes will be attempted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

8.0008, RADIO-FREQUENCY AND LASER SPECTROSCOPY OF BASIC MOLECULES
W. Lichten, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (PHY78-26138)

A program of high-resolution, high-precision, laser spectroscopy of fundamental atomic systems will be continued. The purpose of this research will be two-fold: 1 - to test the theory of one- and two-electron atomic system; 2 - to measure natural constants to higher precision than previous values.

The first experiment will be a measurement of the 2s-3p transition in atomic hydrogen to one part in 10 to the 8th power, to confirm the recent measurements of Hansch et al. Succeeding measurements will aim for a precision of 2 parts in 10 to the 9th power. These experiments will give new values for the Rydberg constant.

An investigation will be made of the feasibility of high-precision measurements of the spectrum of atomic helium, in order to test the theory of two-electron systems more critically than has been possible in the past.

This is the first year of a two-year continuing grant, currently supported under NSF grant PHY75-03264A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0009, SYSTEMATIC ANALYSIS OF ISIS 1 AND 2 LOW-ENERGY AURORAL PROTONS
J.R. Sharber, Florida Inst. of Technology, School of Science & Engineering, Dept. of Physics, *Country Club Rd., Melbourne, Florida* 32901 (ATM77-15257)

Soft particle spectrometers on the polar-orbiting satellites ISIS 1 and ISIS 2 measure the differential energy spectra of precipitating auroral electrons and protons over the energy

range 10 eV to 13 keV. This grant will support a systematic analysis of approximately 2 1/2 years of ISIS proton data accumulated through 1972 which will define the variation of the proton energy spectrum, intensity, and angular distribution with geomagnetic latitude, magnetic local time, and substorm phase. Results obtained for the proton population will be compared with the better known features of the electron population. The investigation will provide a more thorough understanding of particle acceleration within the magnetosphere and over the auroral ionosphere. With its emphasis on the substorm phase, it should also provide a more complete description and understanding of the substorm process, a process which still lacks full explanation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0010, COMPUTER MODELING OF AMORPHOUS MATERIALS FOR PHOTOVOLTAIC CONVERSION
L. Guttman, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (004286 TICNO; 49584)

Amorphous silicon-hydrogen alloys having shown promise as material for cheap and efficient photovoltaic cells, it is desirable to understand their electronic structure in anticipation of problems that will arise in practice. We construct computer analogues that are faithful representations of the atomic structure of pure amorphous Si, and compute from first principles the electronic wave functions and level energies of examples that contain hydrogen or that are defective in various ways. The results are expected, first, to aid in the interpretation of the effects of hydrogen on electrical resistivity and photoconductivity, and second, to provide guidance in understanding the relation of the transport properties of these materials to their composition, thermal history, and to other parameters of the fabrication process. The modelling program is being closely integrated with concurrent work on preparation of amorphous silicon films and neutron diffraction studies of their structure (supported by the Division of Basic Energy Sciences).

SUPPORTED BY U.S. Dept. of Energy, Office of Conservation & Renewable Energy

8.0011, MATERIALS PREPARATION AND CHARACTERIZATION
S. Susman, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (005318 TICNO; 58800)

The preparation of single-crystal research specimens with controlled and reproducible properties is an essential aspect of any broadly-based solid-state research effort. This program is involved with the operation of a facility which can provide and characterize such samples. It is presently operating in collaboration with other Division programs to provide suitable materials, while continuing basic studies of unique materials systems and novel methods of preparation. Current interest is focussed on materials related to studies of fast-ion transport in solids, ternary superconductors, and systems which display itinerant magnetism.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0012, ACCELERATOR OPERATIONS SUPPORT
R. Huson, U.S. Dept. of Energy, Fermi National Accelerator Lab., *P.O. Box 500, Batavia, Illinois* 60510 (006335 TICNO; CH-3000-202)

Accelerator Operations Support includes the design, fabrication, installation, maintenance, repair, testing, component improvement, and other miscellanea required for efficient operation of all accelerator systems and primary proton beam switchyard systems. Operational support activities relative to accelerator systems (preaccelerators, LINAC, booster, main accelerator, and beam extraction and switchyard) are performed in close coordination with the activities of the general accelerator R&D program. In recognition of this and to avoid repetition, those activities are described together under the General Accelerator R&D sub task (03-a-1).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of High Energy & Nuclear Physics

8.0013, SEMICONDUCTOR CRYSTAL GROWTH BY ION BEAM SPUTTERING
J.E. Greene, University of Illinois, Urbana Champaign Campus, Materials Research Lab., *Urbana, Illinois* 61801 (EY-76-C-1198)

This is a new project in which we propose to investigate the growth kinetics, physical properties, and structural stability of unique metastable semiconducting thin films. We have recently demonstrated the growth of single crystal InSb/sub 1-x/Bi/sub x/ and (GaSb)/sub 1-x/Ge/sub x/ films, which represent two subclasses of these metastable alloys. The underlying feature which allows the growth of such materials is the use of controlled low energy (25 to 250 eV) ion bombardment of the subtrate and growing film during vapor phase deposition. Thus the study of energetic particle-surface interactions is a central theme of our research. Ion bombardment during film growth results in significant modifications of elemental sticking probabilities, adatom surface mobilities, film nucleation characteristics, island coalescence, and ultimate film structure. The resulting single crystal metastable films can be thermally stable to several hundred degrees C and they exhibit unique electro-optic properties.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0014, OPTICAL STUDIES OF SEMICONDUCTOR SUPERLATTICES
M.V. Klein, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DN075465; N00014-80-C-0701)

Future Navy needs for advanced electronic system capability will require new device concepts and development of new materials to provide higher power and faster operating solid-state devices.

The investigator will use light scattering techniques such as Raman spectroscopy, Brillouin scattering, and far-infrared absorption measurements to investigate the lattice dynamical properties of multilayer superlattices and quantum well structures in III-V compound semiconductor heterostructures. Studies will be made of the raman spectra due to suggested models of electron-phonon coupling involving excitations between quantized hole and electron levels in the quantum wells. Also, two-dimensional electron gas plasmon oscillations should couple to the phonon modes which will give other information. Brillouin scattering will be used to measure acoustic phonon velocities to use in model calculations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0015, THEORY OF SUPERIONIC CONDUCTORS
G.D. Mahan, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DF045800; AFOSR-76-3106)

AF function - this proposed research primarily falls in the 5.3 ROS which deal with electrical power from non-nuclear energy sources. In particular the use of superionic conductors as solid electrolytes has high potential for development of new batteries and energy storage devices. These batteries will be used for electrical power in manned and unmanned aircraft, satellites and space stations, as well as electrical power for unattended ground-based systems. Deficiency - substantial improvements are needed in organic and solid electrolytes to increase conductivity to that achieved in aqueous electrolytes. These solid electrolytes have a much wider temperature range and are needed for use in new high energy, high charge and discharge rates rechargeable batteries in future aircraft applications as well as space applications. Objective - to investigate why AgI and materials based upon the compound are such good superionic conductors. It is expected that this is related to its preference for tetrahedral bonding, which is related to the filled D-band which

provide the bonding orbitals of Ag. Contribution -this research is a part of a comprehensive program in superfluids and superconductors.

It is proposed to investigate why AgI and materials based upon the compound, are such good superionic conductors. It is expected that this is related to its preference for tetrahedral bonding, which is related to the filled D-band which provide the bonding orbitals of Ag(plus). First, the absolute energies of occupied valence states and also holes will be calculated for the zincblende lattice which these materials have at room temperature. The same calculation will be done for the a-AgI structure found at high temperature. The techniques will use the localized-hole-point-ion model which has been previously developed, and applied to rocksalt lattices. The computer codes will be altered to permit complex logic, which is all that is necessary for the zincblende and other four-fold crystal structures. The PI will use his D-band results above to determine whether there is any direct connection between D-bands and tetrahedral bonding. There are simple questions such as why AgBr and AgCl are not tetrahedral, although AgI and CuBr are fourfold. The PI also proposes to investigate the new crystal-predicting scheme of Narayan and Ramaseshan.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0016, PHONON SPECTROSCOPY IN RARE EARTHS AND RARE-EARTH-IRON COMPOUNDS

H.A. Blackstead, University of Notre Dame, College of Science, Dept. of Physics, *Notre Dame, Indiana* 46556 (DMR78-03013)

This research was previously supported under NSF grant DMR-7302551.

A unique tunable spin-phonon spectrometer will be used to measure the phonons emitted from magnetic materials in a radio-frequency magnetic field. These measurements will be complemented by conventional pulse-echo spectroscopy and microwave spectroscopy and will be used to gain a detailed understanding of dynamic magneto elastic effects in rare earth metals and rare-earth-iron alloys which have unusually large magnetostrictions. These materials will be either in the form of thin films or oriented single crystals and can be either crystalline or amorphous in their atomic structure. The rare-earth-iron materials will be evaluated to determine the most effective rare earth composition as a magneto-acoustic transducer.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, STRUCTURE OF THE UPPER ATMOSPHERE

J.M. Forbes, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF047160; AFOSR-77-3223)

AF function - variations in neutral atmospheric structure are of importance to satellite missile design and operation, and have important effects on communications systems. For instance, satellite ephemeris prediction, missile trajectory prediction, missile plume simulations and computer simulation of nuclear blast effects are operational problems which are affected by neutral atmospheric structure. Deficiency -significant physical influences of atmospheric tides upon D and E region ion chemistry are not included in existing models. These processes must be included to permit development of the most complete models describing D and E region chemistry, structure and behavior. Objective - to investigate and model the effects of atmospheric tides on D and E region ion chemistries and to extend existing D or E region models of ion processes to the other. How work contributes - improved models of diurnal tides and density influences at these low altitudes will expand the basis for the models of mesopheric/thermospheric coupling necessary for satellite drag and communication purposes.

Models of D and E region dependencies upon atmospheric tidal motion will be expanded to include water cluster ion chemistry of the D region into an exisitng time dependent model for the E region - a model of tidal induced oscillations in D and E region density, temperature and winds will be developed based upon results from the previous grant -seasonal-latitudinal effects of tides on ion chemistry will be numerically simulated - and a model will be developed to investigate and predict the effects of tidal transport of long-lived species on the D-and E-region ion structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0018, POSITRONIUM EXPERIMENTS

S. Berko, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (PHY78-24702)

Positronium (Ps), the electron-positron bound state, has long been recognized as the ideal 'atom' to be investigated as a test of the quantum electrodynamical theory of atomic systems. However, it has only been recently that the elusive first excited state (n equals 2) of Ps could be observed, and thus lay the ground work for precise testing the 'Lamb shift', i.e., radiative-correction measurements.

A program of obtaining high precision measurements of the n equals 2 Ps fine-structure through improved microwave techniques and an investigation of the Ps production phenomena will be continued. The investigation of the Ps emission is aimed at improving the yield of n equals 2 Ps, producing sub-eV Ps emission velocities, as well as carrying out a proposed first direct measurement of the Ps-helium scattering cross-section.

This is the first year of a three-year continuing grant, currently supported under NSF grant PHY76-23883A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, CATOPTIC X-RAY OPTICAL SYSTEMS

J.F. McGee, St. Louis University, School of Arts & Sciences, Dept. of Physics, *221 N. Grand Blvd., St. Louis, Missouri* 63103 (DF050630; AFOSR-78-3480)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of the various radiation processes occurring in plasmas. Deficiency - this aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by experimental work requiring advanced x-ray instrumentation. Objective -this project will perform theoretical and experimental research for the development of a compound catoptric x-ray microscope having both high resolution and large magnification. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental research for the development of a prototype 'compound' catoptric x-ray microscope which will have high resolution and large magnification. This will accordingly reduce the resolution requirements of the recording film or associated x-ray image intensifier. It would be distinguished by its 'large working distance'. To reduce further the resolution to its theoretical limit a thorough understanding of the aberration coefficients peculiar to focusing x-rays at grazing angles should be developed. There is always the possibility of using one aberration coefficient to counteract another and thus achieve an overall reduction of aberrations and increased resolution. Earlier x-ray microscopes had a resolution limit of approximately 3000 angstroms and a very limited field of view. Current research suggests that a resolution of 500 angstroms and a 2000 micron field of view is possible. Confirming experiments in the long wavelength region (10 angstrom) are in progress.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, THEORETICAL STUDIES OF FUNDAMENTAL LATTICE ABSORPTION IN HIGHLY TRANSPARENT SOLIDS

J.R. Hardy, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (DN075609; N00014-80-C-0518)

The emergence of high power microwave sources brings forth a need for understanding the nature of their interaction with materials. RADOMES and IR domes will largely absorb submillimeter radiation and absorb somewhat in the 3 mm atmospheric window. This can be ascribed to the difference of multiphonon effects whose nature is only partially understood.

A new method for dealing with multiphonon absorption, especially at high temperatures is being formulated. This is based upon the concept that the behavior of anharmonic oscillators at high temperatures can be treated classically rather than quantum mechanically. However, the dynamical problem is still very complicated and it will be approximated by a computer simulation of the motions. The interaction with radiation is treated as the driven motion of charge particles. It is planned to calculate the frequency and temperature dependence of millimater wave absorption for simple compounds and then extend the results to more practical cases.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0021, AURORAL PLASMA STABILITY

R.L. Kaufmann, University System of New Hampshire, University of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM79-05572)

This award will continue a study of linear plasma instability in the auroral ionosphere. The immediate goal of this study is to be able to predict the detailed spectrum of high frequency wave turbulence that is generated by the energetic electrons which are actually measured on rocket flights. Analysis to date has used data from only a small part of one flight. This work will complete an investigation of this flight and permit analysis of data from a second flight that encountered a substantially different electron population. Another payload that is currently being constructed has been specifically designed to measure both energetic electrons and the electrostatic wave structures that have been predicted.

The overall aim is to understand wave phenomena in space plasmas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0022, H-1 OPERATIONS

W. Hooke, Princeton University, Plasma Physics Lab., *Box 430, Princeton, New Jersey* 08540 (EY-76-C-02-3073)

The linear and nonlinear aspects of the coupling of electromagnetic waves in waveguide arrays to lower hybrid waves are studied. Simple, inexpensive arrays are devised that minimize surface wave excitation and accompanying deleterious nonlinear effects on wave coupling. The nature of the daughter waves generated in the scattering of lower hybrid waves from planar and non-planar surfaces is studied to determine whether the vacuum vessel affects the reemission of lower hybrid waves scattered out of the plasma. The work on RF current generation in collisional plasmas is extended to collisionless plasmas, which are of more interest for toroidal current drive. Preliminary experiments were performed on RF end-plugging with large amplitude microwave fields applied from apertures in cavities.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Fusion Energy

8.0023, AN EXPERIMENTAL STUDY OF SUPERFLUID HELIUM

W.I. Glaberson, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-25409)

This research is a continuation and extension of work supported under NSF Grant No. DMR-7682339. A variety of experiments will be done to probe the structure of quantized vortices in superfluid helium-4, the nature of the ion-vortex interaction and the hydrodynamics of rotational liquid helium. A recently developed, very sensitive temperature gradiometer and chemical potential detector will be used to observe a variety of thermorotational effects involving thermal counterflow in rotating superfluid helium-4. The objective of these studies is to probe such phenomena as critical velocities, vortex pinning and simple hydrodynamic instabilities. Fourth-sound resonances will be studied at higher rotational speeds than previously attained. Such data will aid in the determination of the nature of the vortex distribution in a strongly pinned configuration and provide information about relaxation phenomena in the flow configuration. A fourth-sound Helmholtz resonator will be used to study the anisotropic properties of the A and B phases of superfluid helium-3. This work is important for our fundamental understanding of quantum fluids; that is, macroscopic quantum effects.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, DIATOMIC MOLECULE PROPERTIES IN THE INTERMEDIATE ENERGY TO DISSOCIATION LIMIT RANGE

C.L. Beckel, University of New Mexico, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Hill N.E., Albuquerque, New Mexico* 87106 (DF046320; AFOSR-77-3132)

AF function - this research contributes to research objective 6.1, Nuclear Weapons Effects. Deficiency - weapons effects computer codes need information on the energy levels of diatomic molecules. Objective - this program is directed toward achieving better understanding of and more useful procedures for treating diatomic molecule bound states in the intermediate to high energy range. Contribution - this research will permit more reliable description of diatomic molecule properties in high-energy, high-temperature environments.

Expressions are being developed that relate vibration-rotation eigenenergy E-sub-V, J to vibrational quantum number V. Eigenvalues are being found for a set of model potentials and a corresponding set of actual potentials that correlate with a variety of separated atom states. Reduced mass is being varied to vary eigenvalue density as an aid in determining E-sub-V, J versus V functional forms. Possible causes for failure of the RKR method near dissociation are being evaluated and improvements are being devised to make RKR useful at high V.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0025, ATOM-SURFACE INTERACTION

N. Tzoar, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. at 138th St., New York, New York* 10031 (DN575260; N00014-75-C-0949)

Atoms adsorbed on surfaces are important to many areas of interest to the Navy, including surface reactions, adhesion, lubrication/friction/wear, and electronic devices. A new analytical tool (electron stimulated desorption) is being studied theoretically to clarify the understanding of adatom-surface interactions.

The contractor will study theoretically the phenomena of electron stimulated desorption from a surface, including the excitation process, the dynamics of desorption, and possible deexcitation mechanisms.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0026, COMMUNICATIONS - ATOMIC STRUCTURE AND ATOMIC PROCESSES IN INTENSE LASER FIELDS

M.H. Mittleman, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DN223480; N00014-76-C-0014)

The objective is to investigate the effects of laser radiation on atomic and molecular processes. These effects can be important in scaling of laser systems or transmission of high intensity laser beams and thus are of interest to the Navy's weapons systems. They are also important to the Navy with regard to their application to isotope separation for naval reactors.

The expansion for the T-matrix describing electron-atom scattering is being extended to third order, and electron-atom resonances are being included. The T-matrix element for multiphoton ionization with the absorption of more photons than is necessary for ionization is being derived.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0027, SOLIDS BY POSITRON ANNIHILATION

W. Brandt, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *100 Washington Sq. E., New York, New York* 10003 (DMR76-81771)

The experimental and theoretical studies of positrons in solids previously supported by DMR74-11678 A02 will be continued. Efforts will be directed to further development of the theoretical basis for the positron method, the measurement of the transport properties of positrons in solids, and expansion of the analysis of positronium formation processes in dipolar and photo-magnetic substances, and the investigation of the interaction of positrons with solid surfaces.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, HIGH-RESOLUTION OPTICAL MEASUREMENTS, ATOMIC HYPERFINE STRUCTURE AND ISOTOPE SHIFT

H.H. Stroke, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *100 Washington Sq. E., New York, New York* 10003 (PHY79-09173)

The atomic electron-nuclear interaction is used to study the electric charge and magnetic structures of the nucleus. High-resolution optical techniques are used to measure the resulting hyperfine structures and isotope shifts. The sensitivity of these optical techniques is such that experiments are being done with samples as low as 1 nanogram of material. This permits work with short-lived radioisotopes, and, in turn, systematic studies of the nuclear structure properties over wide ranges of isotopes and isomers. In Mg this extends (including work at CERN) over 25 mass numbers, and 8 isomers. The study has revealed sudden changes of deformation and has confirmed the validty of the Coriolis coupling model for these nuclei. Work is being extended farther into neutron deficient regions for nuclei in the vicinity of doubly-magic 208Pb. This is a continuation of a spectroscopy program at N.Y.U., which also included studies of radiation processed (coherence effects in anomalous dispersion, anomalous principal series doublet intensity ratios in cesium - the Fano effect, and solar chromospheric emission).

This research is a continuation of that previously supported by NSF grant PHY76-21099A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, ISOSPIN AND GIANT-RESONANCE EFFECTS IN NEUTRON SCATTERING AND NEUTRON-INDUCED CHARGED-PARTICLE REACTIONS

J. Rapaport, Ohio University, Athens Campus, School of Arts & Sciences, Dept. of Physics, *Athens, Ohio* 45701 (PHY78-09911)

This grant will support a program of basic research in nuclear physics. An 11-MEV high intensity pulsed Tandem Van de Graaff accelerator produces mono-energetic neutrons which are being used to carry out studies of neutron-nucleus interactions. Studies of isospin and giant-resonance effects in neutron scattering will be carried out. An entirely new technique to study neutron-induced charged-particle reactions with previously unavailable and flexibility will be further developed.

Giant resonance effects will be studied using high-energy neutrons as probes. Studies of inelastic scattering from several targets will be done in order to see directly these giant states, or as in the case of Carbon-12, to answer other basic questions such as isospin mixing. Measurement of the excitation functions of excited states in isospin equals 0 nuclei will be carried out with high energy neutrons to study the influence of these giant states on the scattering to lower states.

A new facility capable of a broad range of neutron-induced charged-particle reaction studies will be developed. Important questions of basic physics as well as important applications will also be pursued.

This is a continuation of work supported under NSF grant PHY76-11450 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0030, INVESTIGATION OF THE ION-FOIL INTERACTION

R.M. Schectman, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (PHY80-05102)

A detailed program of study of the ion-foil excitation process will be continued. Particular emphasis is placed on determining the distribution of and coherence between the magnetic substates produced, utilizing measurements of the angular polarization and quantum beats present in the emitted radiation. To avoid complications of uncertain atomic structure, the systems H I, He I and He II will be studied. New efforts will include studies of different target materials under ultra-high vacuum conditions, and the use of molecular beams through foils of varying thicknesses to provide a known distance and field strength scale to be superposed on the still poorly known surface interaction.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0031, MAGNETIC INTERACTIONS IN SALTS OF THE TRANSITION METALS

S.A. Friedberg, Carnegie Mellon University, Mellon College of Science, Dept. of Physics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DMR78-08651)

Professor Friedberg is continuing and extending a series of investigations at low temperatures of magnetic interactions in transition metal salts belonging in several categories. These include compounds in which (1) single ions or exchange-coupled clusters of ions with singlet ground states interact with energies smaller than the separation of that ground state from a magnetic excited state; (2) dominant spin interactions occur in one or two dimensions; (3) spins order in three-dimensional arrays; and (4) coupled spins occur in isolated clusters. Heat capacities, magnetocaloric effect, magnetic susceptibility, magnetization, magnetic resonance, and neutron scattering are being measured above approximately 30 mK in fields as large as approximately 120 KOe. The problems under study include field-induced electronic ordering and electron-nuclear effects in singlet ground-state systems; tricritical behavior in metamagnets; anomalous field-dependence of TN and bicritical behavior in systems with predominantly low-dimensional spin coupling; and, identification of novel low-dimensional magnetic systems.

This is a continuation of work supported under DMR 75-13908. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, IONOSPHERIC PLASMA STRIATIONS

N.J. Zabusky, University of Pittsburgh, School of Arts & Sciences, Dept. of Mathematics & Statistics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DN880192; N00014-78-C-0074)

To understand striation evolution in ionospheric plasma clouds. In particular, determine the time scales for the formation

of structured clouds investigate the cleavage process and provide estimates of late-time striation power spectra.

The work consists primarily of theoretical and analytic investigations of striation evolution. Some numerical techniques and small scale computer usage will be incorporated. The directions and results will be coordinated with the large scale theoretical and computer simulation work underway at NRL.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0033, HEAVY LEPTON CATALYSIS IN THE P-P I CHAIN

C.K. Au, University of South Carolina, School of Science & Mathematics, Dept. of Physics & Astronomy, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (PHY79-01053)

This work is in the field of theoretical physics and seeks to explore the role that certain yet to be observed elementary particles may have on the fusion reaction, which is the source of power for stars. Specifically the work will examine the role of possible heavy, stable, negatively charged leptons as catalysts in the reaction pp yields a deuteron a positron and a neutrino. The existence of such leptons is not forbidden. If this catalysis is indeed important, it is more likely to manifest itself in smaller stars. The present solar neutrino puzzle may indeed be such a manifestation.

In addition to its astrophysical importance, this problem presents an excellent opportunity to utilize a mathematical technique developed recently in the solution of the three-body problem. It involves calculations of the structure of three-body bound states, rate of information of such bound states and rate of nuclear transmutation while in such bound states.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0034, MOLECULAR RESEARCH WITH ELECTRON SPECTROSCOPY

T.A. Carlson, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (004483 TICNO; 00059(04))

The basic process of ionization and the attendant information on the electronic structure of molecules and atoms is under investigation by means of angle-resolved photoelectron spectroscopy. These studies are being carried out as a function of photon energy with particular emphasis on the use of synchrotron radiation. Results are being obtained on partial cross sections, angular parameters, and resonance absorption. Theoretical calculations are underway to allow the experimental data to be a test of the fundamental understanding of the photoionization process. In particular, the aims of this program will be: (1) to provide an evaluation of the molecular wave functions through differential cross section measures; (2) to understand the dynamics of ejecting an electron from a free molecule; (3) to test the concepts of electron correlation in atoms; (4) to provide the basis for using photoelectron spectroscopy in the determination of the nature of surface adsorption of molecules related to heterogeneous catalysis; and (5) to provide a basis for a better understanding of the electronic structure of small clusters.

BIBLIOGRAPHIC REFERENCES: Krause, M.O., Atomic Radiative and Radiationless Yields for K and L Shells, J. Chem. Phys. Ref. Data 8: 307 (1979). Krause, M.O., and J.H. Oliver, Natural Widths of Atomic K and L Levels, K alpha X-Ray Lines and Several KLL Auger Lines, J. Chem. Phys. Ref. Data 8: 329 (1979).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

8.0035, TOKAMAK CONFINEMENT THEORY

R.A. Dory, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (003808 TICNO; 00046(19))

The task of Applied Plasma Physics: TOKAMAK Confinement Theory is to formulate, validate, test and apply theories and models of plasma behavior in confinement systems for research and development in the Magnetic Fusion Energy program. The approach is to develop approximate theoretical pictures of the system behavior and to improve these until they are sufficiently accurate for understanding past and present experimental results. These models are then used as an aid in determining critical issues to be addressed in future MFE experiments and for predicting the characteristics of the devices. The ultimate application is the design and optimization of potential magnetic fusion reactors. Presently, a primary emphasis of the Oak Ridge Theory work is the improvement of TOKAMAK devices through optimization and technical invention, such as development of high beta TOKAMAK plasmas by beam injection, pellet fueling and impurity control. We are continuing our strong efforts to relate TOKAMAK theory to our ongoing experments, e.g., the beta driven ballooning instability, and major disruptions. A new area of research, alpha particle dynamics in fusioning TOKAMAKs, has been opened up. This type of research orientation complements the Oak Ridge experiment as well as our ETF technology development efforts and the work in other fusion research laboratories.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Fusion Energy

8.0036, PHASE TRANSFORMATIONS IN THE SOLID STATE

W.D. McCormick, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (F-610)

We are continuing our heat capacity studies of solid-state phase transformations. We have found two thermodynamic phase transitions in K2 Sn Cl6 using the high resolution AC heat capacity technique previously developed under this grant. They occur at 253K and 260K, temperatures which are slightly sample dependent. The upper transition was found to be strongly first order, the lower one weakly so. These results help to clarify some question raised by X-ray, Raman and quadrupole resonance data.

The compound Ca(NH3)6, a good free-electron metal, is known to have a resistivity anomaly and anomalous magnetic behavior of unknown origin at low temperatures. We have measured its heat capacity from 6K to 100K and identified two phase transitions. Both appear to be continuous (no latent heat). A very small anomaly at 38K appears to be associated with the known cusp in the resistivity. A second transition, also continuous, has been found at 12K. This transition was previously unknown but we believe that it is associated with the unusual behavior of the magnetic susceptibility. This discovery is very exciting and we feel that it will have important implications in the solid-state chemistry of the metal ammonia compounds.

SUPPORTED BY Robert A. Welch Foundation

8.0037, MATERIAL SUPPORT TECHNOLOGY - THIN FILMS, SURFACES, AND INTERFACES - A FOURIER-TRANSFORM THEORY OF THEIR ELECTRONIC STRUCTURE

F.E. Harris, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DN775345; N00014-77-C-0319)

The Navy has need for improved performance solid-state electronic devices. One limitation has been a less than adequate understanding of the surface and interface physics of these devices. This program will assess new techniques for obtaining an understanding of these semiconductor surfaces and interfaces.

A new theoretrial approach is being developed for electronic structure calculations on thin films, surfaces and interfaces. The Fourier-transform technique developed for bulk solid calculations is being adapted into a two-dimensional version for application to surfaces. In the first stage, energies and electronic states are calculated at the Hartree-Fock level. At a later stage, electron correlation effects will be included. The properties for simple prototype solids will be calculated first and eventually applied to semiconductors. Various surface reconstruction effects in these materials will be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0038, STORED ION SPECTROSCOPY FREQUENCY STANDARD
D.J. Larson, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DN775566; N00014-78-C-0772)

Stored ion spectroscopy may provide a means of improving and simplifying highly accurate timing devices. Accurate timing is of interest to the Navy through improved positioning and missile accuracy. It may also be of importance in the areas of rapid transmission of digital data and long base line interferometry.

The linewidths and lineshapes of microwave transitions in S minus, O minus and SE minus are being studied. A new ion trap which will be more stable and homogeneous is being designed to fit inside a high homogeneity superconducting solenoid. Photodetachment from individual rotational levels of negative molecular ions is being studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0039, DEFECTS PLUS DISORDER PRODUCED BY ION IMPLANTATION IN SOLIDS
M. Balkanski, Universite de Paris VI - Universite Pierre et Marie Curie, *4 Pl. Jussieu, Paris, France* (DA0D9372; DAERO 78 G0002)

Ion implantation is an important technique for doping semiconductors, vital to military electronics. The disordered layer produced by implantation is only partially restored by annealing, particularly in GaAs. The critical processes involved will be investigated.

The investigation will proceed in two steps: (1) The first step (18 months) will be related to low-medium dose (10 to the 12th power/10 to the 14th power at/cm sq) implanted S and Se in about 20 samples; these samples will be obtained from the same semi-insulating ingot; the thermal stability of this ingot will be characterized prior to implantation. The profile of defects just after implantation (Raman spectrum as a function of wavelength or chemical dissolution step by step) and the kinetics of recrystallization at low temperature (100 degrees C - 300 degrees C) will be determined; the role of an encapsulating layer (Si3N4 for example) will be studied; electrical characterization will be done after high temperature anneal (up to 950 degrees C). (2) The second step (18 months) will be related to high doses (10 to the 15th power - 10 to the 17th power at/cm sq.) of implanted A1. This approach will benefit on the previous one. Implanted A1 profiles will be studied by SIMS just after implantation and after an annealing treatment at high temperature (900 degrees C). Doses and energies will then be defined in order to obtain a flat profile extending on 2000 A. Thermal recovery of the crystallization will be studied by Raman spectroscopy and luminescence.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, RESEARCH ON INTERORGANIZATIONAL DECISION PROCESSES WITHIN A LARGER ENTITY (DA0E9431)
F. Heller, Tavistock Inst. of Human Relations, *120 Belsize Ln., London, England, United Kingdom* (DA0G3026; DAJA37-80-C-0186)

To study the longitudinal decision process in a medium-sized airport where the central airport management subcontracts tasks to autonomous outside contractors, particularly to study interrelations between influence-sharing behavior over the cycle of the decision process in relation to turbulence and uncertainty and the boundaries of autonomous units.

To examine five interrelated propostions: (1) that turbulence and uncertainty increase the amount of influence/power sharing used in decision making; (2) that amount of influence and power sharing within organization varies with nature of the task; (3) that power sharing tends to concentrate in start-up and finalization phases across the boundaries of organizations - central to autonomous; (4) that influence - power relationships between central management and its autonomous subcontractors is independent of the extent of power sharing used within central management and within the autonomous units; (5) that use of autonomous sub-contractors decreases cost of bureaucracy and increases effectiveness in mid-sized organizations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, GEOLOGIC MAPS OF MARS, 1:15 MILLION SCALE
D.H. Scott, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeological Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-02365)

Geologists from the U.S. Geological Survey and several universities will continue the mapping of Mars using Viking images. Mapping in the Western Hemisphere of the planet will be done on the new 1:15 million-scale base map of the region; in the eastern hemisphere, the geologic data will be compiled on large scale photomosaics until the base map for that region is completed. All map units will be defined as to their type area and assigned positions in the formal time-stratigraphic systems of Mars.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0002, IMAGE RECONSTRUCTION USING LARGE ASTRONOMICAL TELESCOPES
P.A. Strittmatter, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (DF248810; F19628-78-C-0058)

AF function - communications, surveillance, detection, tracking. Deficiency - inability to obtain high spatial resolution images through the Earth's atmosphere. Objective - extend the technique known as speckle interferometry for routine use on satellites and other low light level objects. Begin development of techniques to construct and use large multiple aperture telescope systems for speckle interferometry. How research contributes - by developing techniques to reconstruct images free from atmospheric-induced degradation and adapting these techniques to multiple mirror telescope systems it will become possible for the Air Force to achieve optical resolutions finer than 1 meter at synchronous altitudes with planned multiple mirror telescope systems.

The contractor will use existing instrumentation and techniques to establish a routine observing program on satellites. The contractor will adapt his new multiple mirror telescope for speckle observations and assess the prospects for constructing large (25 meter diameter) multiple mirror systems for image reconstruction purposes. The Arizona group will also continue their development of computer methods to process speckle interferometry data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

10.0003, GENERAL LUNAR PROJECT
D.E. Wilhelms, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (0-9580-02364)

Prepare four publications summarizing lunar geology: 1. A book, Geologic History of the Moon. 2. A review paper, Geology of Ringed Impact Basins. 3. A colored map, Geologic Map of the Central Near Side of the Moon. 4. A four-part map, Paleogeologic Maps of the Moon.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0004, THEORETICAL STUDIES OF PLANETARY ATMOSPHERES

G.E. Thomas, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (ATM80-07055)

This award funds a three-year program of theoretical research into the thermal and chemical properties of planetary atmospheres, with a specific application to the Earth's middle atmosphere (50-100 km). It will investigate the detailed radiative and dynamical processes that are present at mesopause levels in the Earth's atmosphere (80-90 km), with particular emphasis on the origin of the usual conditions in which noctilucent clouds are formed. The radiative eigenfunction technique will be developed for use in middle atmospheric applications including the study of non-equilibrium heating and cooling, as well as the dissipative effects of radiation and other heat transport mechanisms on waves and other types of motion in the middle atmosphere. These studies will also further explore the climatic consequences of past encounters of the solar system with interstellar matter, through the use of one-dimensional numerical atmospheric models under development for the 50-200 km atmospheric region.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, GALACTIC EVOLUTION AND RELATED STUDIES

B.M. Tinsley, Yale University, Graduate School, Dept. of Astronomy, *206 Elm, New Haven, Connecticut* 06520 (AST77-23566)

Theoretical research on the evolution of galaxies and related topics will be carried out. The major projects are studies of field galaxies as probes in cosmology, rates of star formation in normal and peculiar galaxies, and nucleochronologies as constraints on chemical evolution in the solar neighborhood. Specific projects will include a study of chemical evolution in collapse models for the formation of disk galaxies and detailed population models for elliptical galaxies. An analysis of the Hubble diagram and related cosmological parameters will be done taking into account recent theories of galactic evolution. Previous results will be extended in the context of new data and related theories.

This research is a continuation of grant AST-7723566.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, STRONG LANGMUIR TURBULENCE IN MAGNETIZED SPACE PLASMAS

C.S. Liu, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM78-25248)

This grant will support a computer study of the collapse of plasma waves in a magnetic field excited by electron beams or intense electromagnetic radiation. This work will use computer codes already produced for laboratory plasmas. The application will be space plasmas, e.g., auroral streamers, type III solar radio bursts and electron streams in solar flares. This will lead to a study of the nonlinear physics associated with the wave collapse process. In particular, the following will be studied: (a) evolution of wave collapse; (b) the final steady-state of such a wave collapse: (c) the turbulent spectrum of plasma waves.

Finally, detailed comparison between theory and observation will be made.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0007, AURORAL AND AIRGLOW EMISSION PROCESSES

A. Dalgarno, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (ATM78-20971)

This grant funds a combination of atmospheric and molecular calculations that address various problems of interpretation of measurements of the ultraviolet, visual and infrared emissions in the terrestrial airglow and in auroras. The secondary consequences of the emission of extreme ultraviolet photons will also be explored.

Of particular interest is an emission feature observed at 21500-A during auroral activity. The feature has been observed on several occasions and tentatively identified as the (1,0) gamma band of nitric-oxide (NO). However no other associated bands have been observed, and a number of studies have sought to explain the feature through various mechanisms. This research will carry out several related calculations leading to predicted resultant spectra that can be tested against newly available observing capabilities (sensitivities).

The detailed interpretation of this and other derived features should yield useful information about atmospheric composition, energetics, and transition/reaction properties.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0008, A COMPLETE SURVEY OF GALAXY REDSHIFTS TO MV EQUALS 14.5 USING A PHOTON-COUNTING DETECTOR ARRAY

M. Davis, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (AST78-24856)

A two-line photon-counting detector array copied from the original design of Dr. S. Shectman has been constructed. The device is well suited for faint object spectroscopy and has been in nearly continuous use since February 1978 for a variety of scientific programs at Mt. Hopkins, Arizona. The primary emphasis is on the undertaking of a complete survey of the redshifts of all galaxies in the Northern Sky with MV less than 14.5 and galactic latitude greater than 40 degrees. The first results from the survey are encouraging and other exciting recent observations have been made. The completed redshift catalog will provide unique data for research in extragalactic astronomy. Intended uses of the catalog include: l) improved understanding of the kinematics and dynamics of galaxies within approximately 100 megaparsecs of the Milky Way, 2) direct measurement of the galaxy covariance function using the redshift as a distance indicator, and 3) improved determination of the luminosity distribution of galaxies and hence the luminosity density of galaxies. These questions are of direct relevance to the cosmological debate of whether the universe is open or closed, and the result of the survey will play an important role in resolving the issue.

This is a continuation of AST-7622675.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, CLASSIFICATION OF BRIGHT GIANT STARS AND SUBGIANT STARS OF TYPES G, K AND M

P.C. Keenan, Ohio State University, Columbus Campus, School of Arts & Sciences, Dept. of Astronomy, *190 N. Oval Dr., Columbus, Ohio* 43210 (AST78-07491)

This project will be concerned with the spectral classification of late-type stars. The observations will be made at the Perkins 72-inch reflector at the Lowell Observatory at Flagstaff, Arizona. The project will involve the classification of suspected subgiant or giant stars. The precise classification of such stars will enable one to obtain more accurate estimates of the distances to stars that have very small or insignificant parallaxes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, NORMAL SPIRALS, BARRED SPIRALS, AND ACTIVE GALAXIES - LARGE-SCALE GAS DYNAMICS IN GALAXIES

W.W. Roberts, University of Virginia, School of Engineering & Applied Science, Dept. of Applied Mathematics & Computer Sciences, *Garrett Hall, Charlottesville, Virginia* 22903 (AST79-09935)

The dynamical behavior of the gas in a galaxy is important to its structure and evolution. Yet this behavior remains poorly understood. This project will continue study of the gas dynamics of several types of galaxies. Normal galaxies will be studied for the presence of Phase III gas, the extremely hot, tenuous part of the interstellar medium thought to be associated with shock waves. These shock waves are considered to be the source of the spiral structre of spiral galaxies. The behavior of the gas in the ring-like structures in some barred spirals and eccentric bars will be studied through numerical models. A time-evolutionary, two-dimensional gas dynamical computer code will be used to investigate activity in the nuclei of elliptical and spiral galaxies showing strong activity. In particular, the influence of the medium in the central regions on matter ejected from the nucleus will be studied. An important part of this study will be to synthesize the theoretical results with observational results in each of the areas of the project.

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VOLUME 19 NUMBER 13/JULY 8, 1981

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N81-21998* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CUMULATIVE INDEX TO THE 1980 ISSUE
Jan. 1981 714 p
(NASA-SP-7037(131)) Avail: NTIS HC $10.00 CSCL 01A

This bibliography is a cumulative index to reports, articles, and other documents introduced into the NASA scientific and technical information system. Abstracts for the entries cited appeared in issues 119 through 130 of Aeronautical Engineering: A Continuing Bibliography (NASA SP-7037). Subject, personal author, corporate author, contract number, and report/accession number indexes are provided. A.R.H.

N81-21999*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
JOINT UNIVERSITY PROGRAM FOR AIR TRANSPORTATION RESEARCH, 1980
Mar. 1981 139 p refs Proceedings of Conf. held at Hampton, Va., 11-12 Dec. 1980
Avail: NTIS HC A07/MF A01 CSCL 01B

Low cost avionics concepts and hardware for general aviation aircraft are discussed. Topics include navigation, guidance, control and display concepts, with special emphasis on application. For individual titles, see N81-22000 through N81-22011.

N81-22000*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 1980 **c03**
Robert W. Simpson *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 3-4 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01B

Several technological aspects governing air transportation at major airports were investigated. Three major areas were emphasized: (1) development of automated decision making for dynamic scheduling of runway operations at a major airport; (2) flight evaluation of the performance of low cost Loran C receivers; and (3) design of microcomputer based electronic flight displays for general aviation aircraft. R.C.T.

N81-22001*# Massachusetts Inst. of Tech., Cambridge.
MIT ANNOTATED BIBLIOGRAPHY
In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 5-11 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01B

A bibliography is presented which covers a wide variety of navigation, guidance, control, and display research. Fifteen citations are included. R.C.T.

N81-22002*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
USE OF LORAN-C FOR GENERAL AVIATION AIRCRAFT NAVIGATION **c04**
Krishnan Natarajan *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 13-18 refs (For primary document see N81-21999 13-01) (Grant NGL-22-009-640)
Avail: NTIS HC A07/MF A01 CSCL 17G

Quantitative and qualitative observations were made on the Loran-C in general aviation aircraft. The evaluation of Loran-C for both cross country flights and nonprecision approaches was conducted under simulated instrument flight rules conditions. Particular emphasis was placed on the reliability and failure of Loran-C equipment as well as its susceptibility to atmospheric effects such as P static. Efforts were made to quantify the long term stability of the Loran-C time difference grid. Several E field antenna configurations were also evaluated in terms of performance. Significant results are reported. R.C.T.

N81-22003*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
AN ANALYSIS OF THE ADAPTABILITY OF LORAN-C TO AIR NAVIGATION **c04**
James A. Littlefield *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 19-42 (For primary document see N81-21999 13-01) (Grant NGR-36-009-017)
Avail: NTIS HC A07/MF A01 CSCL 17G

The sources of position errors characteristics of the Loran-C navigation system were identified. Particular emphasis was given to their point on entry as well as their elimination. It is shown that the ratio of realized accuracy to theoretical accuracy of the Loran-C is highly receiver dependent. R.C.T.

N81-22004*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE P/POD PROJECT: PROGRAMMABLE/PILOT ORIENTED DISPLAY **c61**
James A. Littlefield *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 43-50 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 09B

A pilot orientated display system was developed for general aviation aircraft in order to reduce cockpit workloads. Emphasis was placed on the optimization of flight procedural aspects (i.e., interpretation of Loran data). Low cost hardware/software were utilized in the system to reduce developmental costs. Parallel development and testing were conducted on the ground (simulator) and in the air using the same hardware. R.C.T.

N81-22005*# Ohio Univ., Athens. Avionics Engineering Center.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT OHIO UNIVERSITY, 1980 **c03**
Richard H. McFarland *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 53-73 refs (For primary document see N81-21999 13-01)

Avail: NTIS HC A07/MF A01 CSCL 01C

Specific configurations of first and second order all digital phase locked loops were analyzed for both ideal and additive Gaussian noise inputs. In addition, a design for a hardware digital phase locked loop capable of either first or second order operation was evaluated along with appropriate experimental data obtained from testing of the hardware loop. All parameters chosen for the analysis and the design of the digital phase locked loop were consistent with an application to an Omega navigation receiver although neither the analysis nor the design are limited to this application. For all cases tested, the experimental data showed close agreement with the analytical results indicating that the Markov chain model for first and second order digital phase locked loops are valid. R.C.T.

N81-22006*# Ohio Univ., Athens. Avionics Engineering Center.

RESULTS OF A LORAN-C FLIGHT TEST USING AN ABSOLUTE DATA REFERENCE c04

Joseph P. Fischer *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 75-90 refs (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

A closed circuit flight test was conducted using VORs and NDBs as reference points. The Loran-C data collected during the flight was then compared against a reference provided by a discrete address beacon system facility. Information on the equipment configuration in the aircraft, the flight procedure, and the results obtained are presented. R.C.T.

N81-22007*# Ohio Univ., Athens. Avionics Engineering Center.

MICROCOMPUTER PROCESSING FOR LORAN-C c04

Robert W. Lilley, Daryl L. McCall, and Stanley M. Novacki, III *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 97-100 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

Schematic diagrams are presented for the microcomputer processing for Loran-C. Diagrams are included for the following: microcomputer Loran-C loop improvements; Loran-C receiver commutated AGC; and dc-dc power supply. R.C.T.

N81-22008*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT PRINCETON UNIVERSITY, 1980 c03

Robert F. Stengel *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 107-113 refs (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01C

Several aspects of air transportation technology are discussed. The following are included: evaluation of an OMEGA-dead reckoning hybrid navigation system; implementation of a microprocessor controlled flight research ground station; investigation of fuel use characteristics of general aviation aircraft; investigation of a dead reckoning concept incorporating a fluidic rate sensor; experimentation related to ultrasonic altimetry; and concept development for a laser based collision avoidance system. R.C.T.

N81-22009*# Princeton Univ., N. J.

LASER BEACON COLLISION AVOIDANCE SYSTEMS c04

L. M. Sweet, R. B. Miles, E. Wong, and M. Tomeh *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 115-122 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

The development objectives for a laser beacon collision avoidance system are outlined. A system suitable to general aviation aircraft is briefly described. M.G.

N81-22010*# Princeton Univ., N. J.

DEAD RECKONER NAVIGATION PROJECT c04

R. Ellis and L. Sweet *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res. 1980 Mar. 1981 p 123-130 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

A previous dead reckoner involved a classical gyrocompass, a Hewlett-Packard minicomputer, and a true airspeed sensor. In an effort to bring the cost of this system more in line with the realities of general aviation, recent work was done on replacing the minicomputer with a microcomputer and implementing a fluidic rate sensor in the compass system in place of the directional gyro. E.D.K.

N81-22011*# Princeton Univ., N. J.

GENERAL AVIATION AIRPLANE FUEL ECONOMY SYSTEM MODEL c05

L. Sweet and H. Curtis *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 133-142 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01C

The aerodynamic characteristics which affect the fuel consumption of general aviation aircraft are outlined. All data are presented in the form of graphs. R.C.T.

N81-22012*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

A RAPID PERTURBATION PROCEDURE FOR DETERMINING NONLINEAR FLOW SOLUTIONS: APPLICATION TO TRANSONIC TURBOMACHINERY FLOWS Final Report

Stephen S. Stahara, James P. Elliott, and John R. Spreiter Washington NASA May 1981 95 p refs
(Contract NAS3-20836)
(NASA-CR-3425; NEAR-TR-227) Avail: NTIS HC A05/MF A01 CSCL 20D

Perturbation procedures and associated computational codes for determining nonlinear flow solutions were developed to establish a method for minimizing computational requirements associated with parametric studies of transonic flows in turbomachines. The procedure that was developed and evaluated was found to be capable of determining highly accurate approximations to families of strongly nonlinear solutions which are either continuous or discontinuous, and which represent variations in some arbitrary parameter. Coordinate straining is employed to account for the movement of discontinuities and maxima of high gradient regions due to the perturbation. The development and results reported are for the single parameter perturbation problem. Flows past both isolated airfoils and compressor cascades involving a wide variety of flow and geometry parameter changes are reported. Attention is focused in particular on transonic flows which are strongly supercritical and exhibit large surface shock movement over the parametric range studied; and on subsonic flows which display large pressure variations in the stagnation and peak suction pressure regions. Comparisons with the corresponding 'exact' nonlinear solutions indicate a remarkable accuracy and range of validity of such a procedure. J.M.S.

N81-22013# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

SCIENTIFIC REPORT (1980) OF THE RESEARCH DEPARTMENT OF FLIGHT MECHANICS/GUIDANCE AND CONTROL Annual Report

Hans Joachim Holtz 1980 83 p refs Original contains color illustrations
Avail: NTIS HC A05/MF A01

The activities of the German Institutes for Flight Guidance, Flight Mechanics, Aerospace Medicine, and Flight Systems Dynamics are discussed together with those of the Air Transport Science Division. These activities include aeronautics, flight simulation, inflight testing, model testing in wind tunnels, research in rescue and recovery systems, low noise take-off and landing studies, helicopters, human engineering, effects of weightlessness, vacuum and great depths at sea, multibody vehicles, orbit and trajectory mechanics, error analysis, and guided missiles. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-22014 Cincinnati Univ., Ohio.
AN INVISCID SOLUTION FOR THE SECONDARY FLOW IN CURVED PASSAGES Ph.D. Thesis
Shaaban Ahmed Abdallah 1980 124 p
Avail: Univ. Microfilms Order No. 8107477

The secondary flow in turbomachines resulting from the spanwise variation in the flow velocity entering the blade rows is a complex three dimensional flow problem. An analytical formulation for the inviscid rotational flow in curved passages includes three velocity components and the through flow vorticity component. Two hyperbolic first order equations are derived for the through flow velocity and velocity components. The solutions of these equations are introduced in the continuity and vorticity equations which are solved for the secondary flow velocities in cross sectional surfaces normal to the main flow direction. The numerical scheme is very economical and incorporates a marching technique and an efficient method for calculating the secondary flow velocities. This analysis is applied to calculate the three dimensional flow in a 90 deg bend with constant radius of curvature and a rectangular cross section. The numerical results are compared with the experimental data and with the numerical results which are available in the literature. Dissert. Abstr.

N81-22015*# Mississippi State Univ., Mississippi State.
AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAMICS AND COOLING OF A HORIZONTALLY-OPPOSED AIR-COOLED AIRCRAFT ENGINE INSTALLATION Final Report
Stan J. Miley (Texas A and M Univ., College Station), Ernest J. Cross, Jr. (Texas A and M Univ., College Station), John K. Owens, and David L. Lawrence (Turbo West Corporate Aircraft Center, Broomfield, Colo.) Washington NASA Mar. 1981 152 p refs
(Grant NsG-1083)
(NASA-CR-3405) Avail: NTIS HC A08/MF A01 CSCL 01A

A flight-test based research program was performed to investigate the aerodynamics and cooling of a horizontally-opposed engine installation. Specific areas investigated were the internal aerodynamics and cooling mechanics of the installation, inlet aerodynamics, and exit aerodynamics. The applicable theory and current state of the art are discussed for each area. Flight-test and ground-test techniques for the development of the cooling installation and the solution of cooling problems are presented. The results show that much of the internal aerodynamics and cooling technology developed for radial engines are applicable to horizontally opposed engines. Correlation is established between engine manufacturer's cooling design data and flight measurements of the particular installation. Also, a flight-test method for the development of cooling requirements in terms of easily measurable parameters is presented. The impact of inlet and exit design on cooling and cooling drag is shown to be of major significance. Author

N81-22016*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE AND FORCE DATA FOR A FLAT WING AND A WARPED CONICAL WING HAVING A SHOCKLESS RECOMPRESSION AT MACH 1.62
David S. Miller, Emma Jean Landrum, James C. Townsend, and William H. Mason, (Grumman Aerospace Corp, Bethpage, N.Y.) Apr. 1981 333 p refs
(NASA-TP-1759; L-13856) Avail: NTIS HC A15/MF A01 CSCL 10A

A conical nonlinear flow computer code was used to design a warped (cambered) wing which would produce a supercritical expansion and shockless recompression of the crossflow at a lift coefficient of 0.457, an angle of attack of 10 deg, and a Mach number of 1.62. This cambered wing and a flat wing the same thickness distribution were tested over a range of Mach numbers from 1.6 to 2.0. For both models the forward 60 percent is purely conical geometry. Results obtained with the cambered wing demonstrated the design features of a supercritical expansion and a shockless recompression, whereas results obtained with the flat wing indicated the presence of crossflow shocks. Tables of experimental pressure, force, and moment data are included, as well as selected oil flow photographs. E.D.K.

N81-22017*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED METHOD FOR CALCULATING TRANSONIC VELOCITIES ON BLADE-TO-BLADE STREAM SURFACES OF A TURBOMACHINE
Jerry R. Wood Apr. 1981 28 p refs
(NASA-TP-1772; E-128) Avail: NTIS HC A03/MF A01 CSCL 01A

A method was developed to improve the accuracy of an existing computer program used to calculate transonic velocities on a blade-to-blade surface of a turbomachine. The method eliminates problems encountered in obtaining solutions with the velocity gradient equation when large gradients in velocity occur through the blade row. With the improved method, results indicate that the transonic solution can be obtained by scaling the velocities obtained at the reduced mass flow rate where all velocities are subsonic thereby eliminating the need for a solution of the velocity gradient equation. Solutions obtained with the scaling method on a two dimensional compressor cascade and an axial turbine stator show good agreement with experimental data. The results obtained for the stationary blade rows and comparison of analytical results obtained with and without the present method suggest that the method will yield an improved solution for centrifugal compressor impellers. Author

N81-22018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL SIMULATION OF STEADY SUPERSONIC FLOW
Lewis B. Schiff and Joseph L. Steger May 1981 42 p refs
(NASA-TP-1749; A-7923) Avail: NTIS HC A03/MF A01 CSCL 01A

A noniterative, implicit, space-marching, finite-difference algorithm was developed for the steady thin-layer Navier-Stokes equations in conservation-law form. The numerical algorithm is applicable to steady supersonic viscous flow over bodies of arbitrary shape. In addition, the same code can be used to compute supersonic inviscid flow or three-dimensional boundary layers. Computed results from two-dimensional and three-dimensional versions of the numerical algorithm are in good agreement with those obtained from more costly time-marching techniques. Author

N81-22019*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOLUTION OF COMPLEX NONLINEAR PROBLEMS BY A GENERALIZED APPLICATION OF THE METHOD OF BASE AND COMPARISON SOLUTIONS WITH APPLICATIONS TO AERODYNAMICS PROBLEMS
Raymond L. Barger May 1981 29 p refs
(NASA-TP-1857; L-14197) Avail: NTIS HC A03/MF A01 CSCL 01A

A theory for obtaining approximate solutions to nonlinear problems whose exact solutions require the use of large computational procedures is described. The technique represents in some respects a generalization of the method of base and comparison solutions for flows depending on a parameter. For the generalized problem, the input variable is no longer a parameter but a function that is incremented over its entire domain. After performing calculations for a base configuration and a small number of variations of it, solutions for a large class of configurations can be obtained by forming linear combinations of the solution increments. For a restricted class of problems, approximate solutions can be obtained for general variations of a base configuration by using a function-space derivative estimate obtained from a base solution and a single variation. Author

N81-22020*# National Aeronautics and Space Administration, Washington, D. C.
HIGHLY SEPARATED TRANSONIC FLOWS

A. Farcy, V. Mercier, R. LeBlanc, and R. Goethals May 1981 26 p refs Transl. into ENGLISH of conf. paper NT80-18 the Association Aeronautique et Astronautique de France, 1979 20 p Presented at the 16th Colloq. Aerodyn. Appl., Lille, 13-15 Nov. 1979 Original language document was announced as A80-36849 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Centre d'Essais Aeronautique Toulouse, Poitiers, France
(Contract NASw-3198)
(NASA-TM-75874; NT80-18) Avail: NTIS HC A03/MF A01 CSCL 01A

Attention is given to the wind tunnel, to photographic visualization of the flow, and to measurements by pressure probes, hot wire anemometry and laser anemometry. The simultaneous use of different means of measurement provided a good description of the phenomenon, and indicated the existence of shocks and their stability, as well as the existence of the bubble, its dimensions, and in particular, the reattachment of its front. The results show that the bursting (or transition) of the bubble front is produced at an unstable position and creates a point of turbulent intensity which diffuses over the entire height of the flow. T.M.

N81-22021*# National Aeronautics and Space Administration, Washington, D. C.
THREE-DIMENSIONAL SEPARATED FLOWS PAST GROUND VEHICLES
F. Chometon and P. Fontanet (Regie Nationale des Usines Renaut, Boulogne-Billancourt, France) May 1981 34 p refs Transl. into ENGLISH from "Ecoulements Tridimensionnels Decolles Autour de Vehicules Terrestres" (France) Paper NT 80-23, 1979 p 1-31. Presented at Colloq. d'Aerodynamique Appl., Lille, France, 13-15 Nov. 1979; sponsored by Association Aeronautique et Astronautique de France Original language document was announced as A80-36852 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Conservatoire National des Arts et Metiers, Paris
(Contract NASw-3199)
(NASA-TM-75899) Avail: NTIS HC A03/MF A01 CSCL 01A

The separated flow past a thick body is calculated using a theoretical model based on a discrete wake-vortex representation. Rehbach's unsteady inviscid scheme (1977) was used in the three-dimensional analysis. The obstacle is represented by singularities, and the wake is modeled by vortex particles emitted at the separation line. Calculated results for an axisymmetric body are compared with flow visualization results. Author

N81-22022# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANALYSIS AND DESIGN OF A SUPERSONIC RADIAL OUTFLOW SYSTEM Interim Report, Nov. 1977 - Nov. 1978
Siegfried H. Hasinger Oct. 1980 70 p refs
(AF Proj. 2307)
(AD-A097032; AFWAL-TR-80-3028) Avail: NTIS HC A04/MF A01 CSCL 20/5

The design and performance of a radial outflow expansion system is presented. This information is needed for building and operating an experimental radial flow system for cold flow testing of radial diffusers of the type used in high energy radial flow laser systems. In particular, design charts for ring nozzle systems for operation with various gases are developed and effective exit Mach numbers of ring nozzle expansion systems are determined. Some considerations are given to the design of a multi-channel radial diffuser to be tested in the here designed radial flow expansion system. GRA

N81-22023# ILC Industries, Inc., Frederica, Del.
AIR FORCE GEOPHYSICS LABORATORY AERODYNAMICALLY TETHERED BALLOON, 45,000 CUBIC FEET Final Report, Feb. 1973 - Jun. 1979
G. P. Durney and R. W. Lawrence Hanscom, AFB., Mass. AFGL Dec. 1980 103 p refs
(Contract F19628-73-C-0155; AF Proj. 6665)
(AD-A096758; AFGL-TR-80-0367) Avail: NTIS HC A06/MF A01 CSCL 04/1

An empennage ripstop fabric of combined Kevlar and pre-heat set Dacron yarns, and a hull fabric which is a biaxially woven fabric stabilized with an oriented non-woven polyester fabric, were developed. A 45,000 cu. ft. balloon was designed, fabricated and tested. The new material is suitable for construction of balloons in the 100,000 cu. ft. range. The hull fabric developed on this program was later scaled-up and is currently used in USAF 250,000 cu. ft. Seek Skyhook Aerostats. GRA

N81-22024# Sandia Labs., Albuquerque, N. Mex. Technical Translation Service.
TURBULENT STRUCTURES IN THE WAKE OF A HELIOSTAT
J. M. Germa (Centre Scientific et Technique de Batiment Nantes) Jan. 1981 24 p ref Transl. into ENGLISH from Intern. Symp. on Systems of Thermodyn. Conversion of Solar Energy, Nantes, France
(Contract DE-AC04-76DP-00789)
(SAND-81-6000) Avail: NTIS HC A02/MF A01

The systematic wind tunnel study of the wake revealed a periodic alternating and turbulent phenomenon with a vertical axis whose characteristics are close to those of a Karman channel. The particular structure of this wake is attributed to the proximity of the ground. The wake structure is not changed by slight variations in heliostat orientation with respect to the incident wind; the vortex detachment persists when the angles of incidence and sideslip remain less than about 200. For velocities greater than 15 to 20 m/s, the Strouhal frequency of the wake approaches the eigen frequencies of the heliostats. DOE

N81-22025# Sandia Labs., Albuquerque, N. Mex. Aerothermodynamics Div.
COMPARISON OF FIELD AND WIND TUNNEL DARRIEUS WIND TURBINE DATA
Robert E. Sheldahl Jan. 1981 18 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2469) Avail: NTIS HC A02/MF A01

A 2-m-dia Darrieus Vertical Axis Wind Turbine with NACA-0012 blades was extensively tested in the Vought Corporation Low Speed Wind Tunnel. The accuracy of the wind tunnel test data was verified and thus the credibility of that data base was further established. DOE

N81-22026# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
WIND TUNNEL TESTS OF A MODEL AEROFOIL SHIP
W. M. S. Bradbury Sep. 1980 34 p refs
(IC-Aero-80-04; ISSN-0308-7247) Avail: NTIS HC A03/MF A01

Aerodynamic force coefficients were obtained for the model which has eight rectangular sails with symmetric uncambered NACA0018 section. A symmetric section was used so the airfoils may be used with the wind incident on either face. Tests were run with three types of sail set; with sails parallel, with trim angles graduated to attempt identical local flow conditions at all airfoils, and with trim angle reduced in equal steps of n degrees working from bow to stern. Runs were made at various inflow angles. Details of the aerodynamic interaction between sails are noted. Author (ESA)

N81-22027# European Space Agency, Paris (France).
WIND TUNNEL TESTS OF A TUBULAR SUPERSONIC INLET FOR PROJECTILES
Berthold Schaefer Nov. 1980 30 p refs Transl. into ENGLISH of "Windkanaluntersuchung an Einem Ringfoermigen Ueberschalleinlauf fuer Geschossanwendung", Rept. DFVLR-FB-79-26 DFVLR, Goettingen, West Germany, Mar. 1979 Original report in GERMAN previously announced as N80-25367
(ESA-TT-645; DFVLR-FB-79-26) Avail: NTIS HC A03/MF A01

Measurements were carried out in a trisonic wind tunnel in order to investigate the sudden increase of drag of a spinning tubular projectile using models with different cowl angles and fineness ratios. This is part of a program to develop practice missiles which have realistic speeds within battle range, but ground themselves within range boundaries. Test results show that it is possible by the combination of various internal and external angles, area, and fineness ratios to cover a wide drag range. A method to calculate the breakdown Mach number and

drag coefficient with started internal flow is given, and shows good agreement with the wind tunnel tests. Author (ESA)

N81-22028# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE EFFECT OF A GAP ON THE AERODYNAMICS OF A FENCE B.S. Thesis
M. J. Flatt and M. R. Waltham Jun. 1980 43 p refs
(BU-243) Avail: NTIS HC A03/MF A01

The flow associated with a gap under a fence was studied in a wind tunnel as an aid to spoiler design. The combined effects of gap and deployment angle were investigated. All tests were carried out on a flat plate of effectively infinite length, the flow being made two dimensional by fitting endplates. The Reynolds number used was 4,100, based on the fence chord. Visualization techniques enabled a detailed model of the flow to be constructed. The pressure fields on the supporting flat plate were measured for various fence positions and are shown to be consistent with the model. The forces acting on the fence itself were investigated with the finding that a significant proportion of the overall change of forces on a wing would be applied through the spoiler hinge. Flow patterns dependent on gap size were defined. Author (ESA)

N81-22029# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Entwurfsaerodynamik.
COMPUTATION OF PRESSURE DISTRIBUTION ON THE DFVLR WING-BODY MODEL BY THE PANEL METHOD
Romesh Kumar Jain (National Aeronautical Lab.), Guenter Redeker, and Syed Rafeeq Ahmed Nov. 1979 36 p refs
Sponsored in part by DAAD, Bonn
(DFVLR-FB-80-02) Avail: NTIS HC A03/MF A01

The panel method is based on a discrete singularity distribution. The complete surface of a given configuration is divided into a large number of plane quadrilateral or triangular panels and the singularity strength on each of these panels is obtained as a solution of an integral equation. A control point is selected on each panel in order to satisfy the boundary condition. Viscous effects are shown very important for supercritical wings having a large amount of rear loading, and the need to modify the panel method to include boundary layer calculations is highlighted. Author (ESA)

N81-22030# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.
THEORETICAL PREDICTION OF BASE PRESSURE ON MISSILE BODIES HAVING A TURBULENT DEAD AIR REGION AT SUPERSONIC VELOCITIES
Mauri Tanner 1920 80 p refs In GERMAN; ENGLISH summary
Report will also be announced as translation (ESA-TT-708)
(DFVLR-FB-80-29) Avail: NTIS HC A05/MF A01

A theory which predicts the base pressure and aftbody drag, on axisymmetric missile bodies at supersonic velocities is presented. The body is assumed to have a turbulent dead air region behind the base. This theory extends the theory of Oswatitsch which connects the drag of the body with the entropy increase in the flow. Values for missile bodies at angles of incidence < or = 20 deg are approximated. Various calculation examples are shown and a comparison with experimental values shows good agreement between theory and measurement. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N81-22031*# Battelle Columbus Labs., Mountain View, Calif.
A REVIEW OF IN-FLIGHT EMERGENCIES IN THE ASRS DATA BASE Final Report
Richard F. Porter 3 Apr. 1981 25 p
(Contract NAS2-10060)
(NASA-CR-166166) Avail: NTIS HC A02/MF A01 CSCL 01C

A series of 154 in-flight emergencies as reported to the Aviation Safety Reporting System are described. The various types of emergencies are examined and an attempt is made to determine the human errors and other factors associated with each incident, as well as the measures taken to resolve the emergency. It is concluded that nearly one half of those emergencies reported were related to failure or malfunction of aircraft subsystems. Of all the emergencies, nearly one quarter were associated with power plant failure. Other frequently encountered emergency types are associated with operation in instrument meteorological conditions without appropriate clearance or qualification, and with low fuel state situations. Human error is prominently featured in many of the incidents, appearing in the actions of pilots and air traffic controllers. E.D.K.

N81-22032*# Systems Control, Inc., West Palm Beach, Fla. Technology Industries Div.
CANDIDATE CDTI PROCEDURES STUDY Final Report
R. E. Ace Hampton, Va. NASA. Langley Research Center Jan. 1981 80 p refs
(Contract NAS1-16247)
(NASA-CR-165873) Avail: NTIS HC A05/MF A01 CSCL 01C

A concept with potential for increasing airspace capacity by involving the pilot in the separation control loop is discussed. Some candidate options are presented. Both enroute and terminal area procedures are considered and, in many cases, a technologically advanced Air Traffic Control structure is assumed. Minimum display characteristics recommended for each of the described procedures are presented. Recommended sequencing of the operational testing of each of the candidate procedures is presented. S.F.

N81-22033# Boeing Military Airplane Development, Seattle, Wash.
ANALYSIS OF EJECTION SEAT STABILITY USING EASY PROGRAM, VOLUME 1 Final Report, May 1979 - Sep. 1980
Christopher L. West, Brian R. Ummel, and Roger F. Yurczyk Wright-Patterson AFB, Ohio AFWAL Sep. 1980 691 p refs
(Contract F33615-79-C-3407; AF Proj. 2402)
(AD-A096597; AFWAL-TR-80-3014-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 01/3

High performance combat aircraft have extended the maneuvering/operating range into regimes that exceed the capabilities of current ejection seat systems. One of the problems encountered involves the unstable rotational characteristics of the typical ejection seat, resulting in a decreased probability of survival due to the reorientation of the ejecting crewmember into an attitude less tolerant to acceleration. Furthermore, an unstable ejection seat may neither clear the airframe, nor provide adequate ground clearance. The capability to simulate the trajectory of an escape system, and to determine its stability characteristics using classical stability and control methods, is required to enhance the development of both active and passive stability augmentation systems. The objective of this development effort was to develop an ejection seat classical stability analysis capability by incorporating SAFEST computerized simulation subroutines into the EASY program standard component library. The resultant computer program described in this User Manual/document is EASY and SAFEST Integration for the Evaluation of Stability and Trajectory (EASIEST). Volume 1 is a 'stand-alone' user manual describing the EASIEST program characteristics and complete information on the use of the program and how to apply it to ejection seat dynamics and control analysis. It contains listings of the procedure files, models, analysis, standard components, and subroutines. Volume 2 is Boeing proprietary and contains only the source code listings of EASY 5. GRA

N81-22034# Air Force Academy, Colo. Dept. of Mathematical Sciences.
AN INVESTIGATION OF TWO SAFE ESCAPE FROM BASE FLIGHT PROFILES Final Report

Robert A. Rappold Jan. 1981 24 p refs
(AD-A096571; USAFA-TR-81-3) Avail: NTIS HC A02/MF A01 CSCL 01/2

This research establishes two base case scenarios for 'safe escape' profiles for large conventional aircraft. The profiles considered were: (1) a constant altitude dash, and (2) a constant airspeed climb. The flight profile modeling assumed the aircraft had first reached a safe maneuvering airspeed and altitude. Other assumptions were consistent with aerodynamic and pilot limitations and operational considerations. The governing differential equations of motion are derived and the Runge-Kutta numerical solution technique applied. GRA

N81-22035# Air Force Armament Lab., Eglin AFB, Fla.
VELOCITY TOLERANCE OF ESCAPE SYSTEMS Final Report, 1977 - 1979
C. D. Gragg 1 Dec. 1980 28 p refs
(AF Proj. 9993)
(AD-A096881; AD-E800237; AD-TR-80-59) Avail: NTIS HC A03/MF A01 CSCL 01/3

Eighty-four (84) Air Force escape system tests were analyzed for velocity tolerance. The target velocity should not be stated in terms of per cent. This practice has led to some serious under testing of maximum velocities. The velocity tolerance is essentially independent of the magnitude of the velocity. A velocity tolerence of plus/minus 23.5 KEAS (Knots Equivalent Air Speed) will prevent excessive over or under testing. GRA

N81-22000*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 1980
Robert W. Simpson *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 3-4 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01B

N81-22005*# Ohio Univ., Athens. Avionics Engineering Center.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT OHIO UNIVERSITY, 1980
Richard H. McFarland *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 53-73 refs (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01C

N81-22008*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT PRINCETON UNIVERSITY, 1980
Robert F. Stengel *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 107-113 refs (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01C

N81-22437# Lockheed-California Co., Burbank.
AIRCRAFT CRASH DYNAMICS: SOME MAJOR CONSIDERATIONS
In The Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 13, No. 3 Mar. 1981 p 3-6 refs (For primary document see N81-22436 13-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D. C. $15.00/set CSCL 01/9

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N81-22036*# National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW-FREQUENCY RADIO NAVIGATION SYSTEM Patent Application
David E. Wallis, inventor (to NASA) (JPL) Filed 6 Mar. 1981 26 p
(Contract NAS7-100)
(NASA-Case-NPO-15264-1; US-Patent-Appl-SN-241154) Avail: NTIS HC A03/MF A01 CSCL 17G

A method of continuous wave navigation using four transmitters operating at sufficiently low frequencies to assure essentially pure groundwave operation is described. The transmitters are keyed to transmit constant bursts (1/4 sec) in a time-multiplexed pattern with phase modulation of at least one transmitter for identification of the transmitters and with the ability to identify the absolute phase of the modulated transmitter and the ability to modulate low rate data for transmission. The transmitters are optimally positioned to provide groundwave coverage over a service region of about 50 by 50 km for the frequencies selected in the range of 200 to 500 kHz, but their locations are not critical because of the beneficial effect of overdetermination of position of a receiver made possible by the fourth transmitter. Four frequencies are used, at least two of which are selected to provide optimal resolution. All transmitters are synchronized to an average phase as received by a monitor receiver. NASA

N81-22037*# Battelle Columbus Labs., Mountain View, Calif.
POTENTIAL EFFECTS OF THE INTRODUCTION OF THE DISCRETE ADDRESS BEACON SYSTEM DATA LINK ON AIR/GROUND INFORMATION TRANSFER PROBLEMS
Ralph L. Grayson 30 Mar. 1981 47 p ref
(Contract NAS2-10060)
(NASA-CR-166165) Avail: NTIS HC A03/MF A01 CSCL 17G

This study of Aviation Safety Reporting System reports suggests that benefits should accure from implementation of discrete address beacon system data link. The phase enhanced terminal information system service is expected to provide better terminal information than present systems by improving currency and accuracy. In the exchange of air traffic control messages, discrete address insures that only the intended recipient receives and acts on a specific message. Visual displays and printer copy of messages should mitigate many of the reported problems associated with voice communications. The problems that remain unaffected include error in addressing the intended recipient and messages whose content is wrong but are otherwise correct as to format and reasonableness. Author

N81-22038# European Space Agency, Paris (France).
FUNCTIONAL ANALYSIS AND OPERATIONAL ASSESSMENT OF AN ONBOARD GLIDE PATH GUIDANCE SYSTEM FOR VISUAL APPROACHES (VISUAL APPROACH MONITOR VAM)
Josef Thomas and Helmut Stein Dec. 1980 103 p refs Transl. into ENGLISH of 'Funktionanal. u. Operationelle Bewertung eines Bordgestuetzten Gleitpfadfuehrungssystems fuer Sichtanfluege (Visual Approach Monitor VAM)", Rept. DFVLR-FB-79-38 DFVLR, Brunswick, Oct. 1979 Original report in GERMAN previously announced as N81-10043
(ESA-TT-655; DFVLR-FB-79-38) Avail: NTIS HC A06/MF A01

A function and error analysis was carried out on the visual approach monitor (VAM), a head-up display system for manual visual approaches. Its operational characteristics as regards guidance performance and stability were investigated in simulation and flight tests. Flight tests show that under the chosen test conditions the VAM system produces no detectable increase in accuracy compared to visual approaches. However, it leads to significantly reduced scatter and extreme values in almost all flight guidance parameters. The VAM system is approximately comparable to instrument landing systems in its overall guidance performance. Author (ESA)

N81-22002*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
USE OF LORAN-C FOR GENERAL AVIATION AIRCRAFT NAVIGATION

Krishnan Natarajan *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 13-18 refs (For primary document see N81-21999 13-01) (Grant NGL-22-009-640)
Avail: NTIS HC A07/MF A01 CSCL 17G

N81-22003*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
AN ANALYSIS OF THE ADAPTABILITY OF LORAN-C TO AIR NAVIGATION
James A. Littlefield *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 19-42 (For primary document see N81-21999 13-01) (Grant NGR-36-009-017)
Avail: NTIS HC A07/MF A01 CSCL 17G

N81-22006*# Ohio Univ., Athens. Avionics Engineering Center.
RESULTS OF A LORAN-C FLIGHT TEST USING AN ABSOLUTE DATA REFERENCE
Joseph P. Fischer *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 75-90 refs (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

N81-22007*# Ohio Univ., Athens. Avionics Engineering Center.
MICROCOMPUTER PROCESSING FOR LORAN-C
Robert W. Lilley, Daryl L. McCall, and Stanley M. Novacki, III *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 97-100 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

N81-22009*# Princeton Univ., N. J.
LASER BEACON COLLISION AVOIDANCE SYSTEMS
L. M. Sweet, R. B. Miles, E. Wong, and M. Tomeh *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 115-122 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

N81-22010*# Princeton Univ., N. J.
DEAD RECKONER NAVIGATION PROJECT
R. Ellis and L. Sweet *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res. 1980 Mar. 1981 p 123-130 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 17G

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N81-22039*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
KINEMATIC PROPERTIES OF THE HELICOPTER IN COORDINATED TURNS
Robert T. N. Chen and James A. Jeske Apr. 1981 41 p refs (NASA-TP-1773; A-8399) Avail: NTIS HC A03/MF A01 CSCL 01C

A study on the kinematic relationship of the variables of helicopter motion in steady, coordinated turns involving inherent sideslip is described. A set of exact kinematic equations which govern a steady coordinated helical turn about an Earth referenced vertical axis is developed. A precise definition for the load factor parameter that best characterizes a coordinated turn is proposed. Formulas are developed which relate the aircraft angular rates and pitch and roll attitudes to the turn parameters, angle of attack, and inherent sideslip. A steep, coordinated helical turn at extreme angles of attack with inherent sideslip is of primary interest. The bank angle of the aircraft can differ markedly from the tilt angle of the normal load factor. The normal load factor can also differ substantially from the accelerometer reading along the vertical body axis of the aircraft. Sideslip has a strong influence on the pitch attitude and roll rate of the helicopter. Pitch rate is independent of angle of attack in a coordinated turn and in the absence of sideslip, angular rates about the stability axes are independent of the aerodynamic characteristics of the aircraft.
S.F.

N81-22040*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL STUDY OF THE CRUISE PERFORMANCE OF A CLASS OF REMOTELY PILOTED, MICROWAVE-POWERED, HIGH-ALTITUDE AIRPLANE PLATFORMS
Charles E. K. Morris, Jr. Apr. 1981 78 p refs (NASA-TM-81969) Avail: NTIS HC A05/MF A01 CSCL 01C

Each cycle of the flight profile consists of climb while the vehicle is tracked and powered by a microwave beam, followed by gliding flight back to a minimum altitude. Parameter variations were used to define the effects of changes in the characteristics of the airplane aerodynamics, the power transmission systems, the propulsion system, and winds. Results show that wind effects limit the reduction of wing loading and increase the lift coefficient, two effective ways to obtain longer range and endurance for each flight cycle. Calculated climb performance showed strong sensitivity to some power and propulsion parameters. A simplified method of computing gliding endurance was developed.
T.M.

N81-22041# Boeing Vertol Co., Philadelphia, Pa.
CRASHWORTHINESS DESIGN PARAMETER SENSITIVITY ANALYSIS Final Report, Sep. 1979 - Aug. 1980
Anthony E. Tanner Feb. 1981 281 p refs
(Contract DAAK51-79-C-0042; DA Proj. 1L1-62209-AH-76) (AD-A096550; D210-11676-1; USAAVRADCOM-TR-80-D-31)
Avail: NTIS HC A13/MF A01 CSCL 01/2

This program investigated the relationships between aircraft weight, the level of crashworthiness in the design, and the cost and weight associated with crashworthiness elements of the design. Accident and research data were reviewed and actual aircraft designs were analyzed with respect to their levels of crashworthiness and potential improvements. Processing of the data yielded cost and weight curves for use in preliminary design. The curves provide the relationships between gross weight, mean empty weight, levels of crashworthiness, and selected design elements that contribute to crashworthiness for designs employing metallic or composite materials and having gross weights up to 50,000 pounds. Comparisons were made with the current ACAP analyses and results showed good agreement for the weight values and level of crashworthiness. The intent of the curves is to allow the designer to rapidly optimize the weights of a preliminary design with respect to performance and utility, and to assess the impact on crashworthiness of reducing the weight of the structure or other crashworthiness contributions. When weight values are resolved, cost curves are then used. A 'Scout' helicopter was defined for both a metallic and composite structure and comparisons were made using the curves generated in this report.
GRA

N81-22042# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
CALIBRATION OF AN AXIAL FAN AT VARIOUS POWER SETTINGS FOR USE ON A QUARTER SCALE XC-8A AIR CUSHION MODEL Final Report, 1 Oct. 1977 - 1 May 1979
David L. Fischer Nov. 1980 49 p refs
(AF Proj. 2402)
(AD-A097043; AFWAL-TR-80-3094) Avail: NTIS HC A03/MF A01 CSCL 01/3

A method was developed to measure volume flow from electrically powered fans during model testing of a dynamically scaled, quarter-scale XC-8A air cushion model. To measure the volume flow during model operation, the static pressure at a point along the fan inlet duct was correlated with volume flow. Correlation of the fan inlet static pressure with volume flow was performed using one of the two fans used on the model and a fan calibration rig. The fan calibration rig is independent of the model and used the orifice plate method to measure

volume flow. Correlation was performed at five different input voltage settings to the fan from 100 volts/200 cycles to the normal rated voltage input of 200 volts/400 cycles. Reduction of the normal rated voltage was investigated so that the volume flow could be controlled during model operation to more accurately simulate the XC-8A fan performance maps. The results of this work are five sets of graphical data illustrating the fan output static pressure and inlet static pressure versus volume flow. This data will be a key to future research using the quarter-scale XC-8A air cushion model for development of air cushion technology. GRA

N81-22043# Aeronautical Research Labs., Melbourne (Australia).
SEA KING MATHEMATICAL MODEL VALIDATION TRIALS. FLIGHT DATA CHANNEL CALIBRATION
D. T. Hourigan Sep. 1980 44 p refs
(AD-A096587; ARL/AERO-TM-325) Avail: NTIS HC A03/MF A01 CSCL 14/2

Thirty-two channels of flight data were recorded to validate a mathematical model of an R.A.N. Sea King Mk. 50 helicopter. Described is the calibration procedure used for each channel. GRA

N81-22044# Dayton Univ., Ohio.
STRUCTURAL FLIGHT LOADS SIMULATION CAPABILITY, VOLUME 1 Final Report, Jun. 1977 - Sep. 1980
Fred K. Bogner Wright-Patterson AFB, Ohio AFWAL Nov. 1980 190 p refs 2 Vol.
(Contract F33615-76-C-3135; AF Proj. 2402)
(AD-A096572; UDR-TR-80-73-Vol-1; AFWAL-TR-80-3118-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 01/3

An experimental test facility has been developed for performing realistic simulation of flight loads on sections of aircraft wing structures. Concurrently, an analytical technique was developed for predicting the internal load distributions of ballistically damaged, multiple load path aircraft wing structures. In all, six replica wing structures and one T-38 wing structure were tested in the loads facility. The analytically predicted stresses were satisfactory, especially when the response was in the linear range. However, with a substantial amount of damage present and/or when the response was nonlinear, the experimental and analytical results differed substantially. This is thought to be caused by oversimplified finite element models. Further testing is forthcoming. GRA

N81-22045# Dayton Univ., Ohio. Aerospace Mechanics Div.
STRUCTURAL FLIGHT LOADS SIMULATION CAPABILITY. VOLUME 2: STRUCTURAL ANALYSIS COMPUTER PROGRAM USER'S MANUAL Final Report, Aug. 1977 - Sep. 1980
T. S. Bruner, M. P. Bouchard, J. G. Gebara, M. J. Hecht, and Fred K. Bogner Wright-Patterson AFB, Ohio AFWAL Nov. 1980 358 p refs 2 Vol.
(Contract F33615-76-C-3135)
(AD-A096594; UDR-TR-80-73-Vol-2; AFWAL-TR-80-3118-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 01/3

A complete system for the modeling, analysis and post-analysis of wing structures utilizing finite elements in simulated flight loads testing has been developed. The preprocessor incorporated the MAGNA element types 3, 4 and 5 (2-D membrane, truss and thin shells) into three predefined wing class models and allows for the conversion of existing wing models to be analyzed by MAGNA. MAGNA is a very powerful and flexible material and geometrical nonlinear analysis program capable of solving a wide variety of finite element problems. Two postprocessors are coupled to the modeling and analysis of the wing structures to provide model geometry, stress or strain contour or relief displacement plots of the model and analysis results. GRA

N81-22046# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE DEVELOPMENT OF THE SECONDARY WING STRUCTURE FOR A RIGID WING HANG GLIDER B.S. Thesis
C. P. Blackman and I. Grant Jun. 1980 39 p refs
(BU-251) Avail: NTIS HC A03/MF A01

The design, construction and testing of a secondary wing structure using foam and glass fiber sandwich construction are described. Materials and construction techniques used were those readily available to the amateur. The wing section, an FX 72-MS-150B, was modified to simplify construction. Load tests were conducted on the iron on plastic film covering material. Static loading tests and an aerodynamic loading test in a wind tunnel were carried out, the latter on a 1.52 m span, section of the full scale wing. The structure proves to be more than adequately strong, although its weight would be only 4.14 kg. Author (ESA)

N81-22011*# Princeton Univ., N. J.
GENERAL AVIATION AIRPLANE FUEL ECONOMY SYSTEM MODEL
L. Sweet and H. Curtis *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 133-142 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-22047*# Sperry Flight Systems, Phoenix, Ariz.
V/STOLAND DIGITAL AVIONICS SYSTEM FOR XV-15 TILT ROTOR Final Report
Sam P. Liden Jan. 1980 381 p
(Contract NAS2-10328)
(NASA-CR-152320) Avail: NTIS HC A17/MF A01 CSCL 01D

A digital flight control system for the tilt rotor research aircraft provides sophisticated navigation, guidance, control, display and data acquisition capabilities for performing terminal area navigation, guidance and control research. All functions of the XV-15 V/STOLAND system were demonstrated on the NASA-ARC S-19 simulation facility under a comprehensive dynamic acceptance test. The most noteworthy accomplishments of the system are: (1) automatic configuration control of a tilt-rotor aircraft over the total operating range; (2) total hands-off landing to touchdown on various selectable straight-in glide slopes and on a flight path that includes a two-revolution helix; (3) automatic guidance along a programmed three-dimensional reference flight path; (4) navigation data for the automatic guidance computed on board, based on VOR/DME, TACAN, or MLS navid data; and (5) integration of a large set of functions in a single computer, utilizing 16k words of storage for programs and data. A.R.H.

N81-22048*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AIRCRAFT BODY-AXIS ROTATION MEASUREMENT SYSTEM Patent Application
Kenneth T. Cowdin, inventor (to NASA) Filed 11 Mar. 1981 22 p
(NASA-Case-FRC-11043-1; US-Patent-Appl-SN-242790) Avail: NTIS HC A02/MF A01 CSCL 01D

A two-gyro four-gimbal attitude sensing system providing continuous aximuth information as the aircraft turns on its roll axis while the near vertical flight, and for preventing tumble of platforms in gyro systems upon departure from near vertical flight, is described. The provision of continuous azimuth information allows recovery from vertical on a desired heading. The system is comprised of means for stabilizing an outer roll gimbal that is common to a vertical gyro and a directional gyro with respect to the aircraft platform which is being angularly displaced about an axis substantially parallel to the outer roll gyro axis, and means for producing a signal indicative of the magnitude of such displacement as an indication of aircraft heading. Means are provided to cause stabilization of the outer roll gimbal prior to entering vertical flight and destabilization of the outer roll gimbal when departing vertical flight. J.D.H.

N81-22049# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
LASER DOPPLER AIRSPEED AND ALTITUDE SENSOR Final Report, 15 Oct. 1977 - 15 Nov. 1980
M. J. Rudd Feb. 1981 72 p refs
(Contract F49620-78-C-0023; AF Proj. 2305)
(AD-A096980; AFOSR-81-0309TR) Avail: NTIS
HC A04/MF A01 CSCL 17/8

The feasibility of an air data system based on the measurement of the resonant fluorescence of carbon dioxide in the atmosphere is discussed. The Doppler shift of the fluorescence gives the air velocity and the linewidth gives the pressure altitude. A system using a tunable diode laser has been set-up and characterized. Attempts to measure back-scattered fluorescence were unsuccessful, but inelastic scattering in the forward direction was observed. Mechanisms for this are discussed but no firm conclusion is reached. A correlation technique for processing the data is discussed and its accuracy computed. GRA

N81-22050# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
FLIGHT EVALUATION OF THE CONCEPT OF THE STAGE A PERIPHERAL VISION HORIZON DEVICE (PVHD) USING THE CH 135 AIRCRAFT OF 403 SQUADRON - CFB GAGETOWN
R. C. Rud and R. D. Michas 8 Dec. 1980 9 p refs
(AD-A096870; DCIEM-TC-80-C-66) Avail: NTIS
HC A02/MF A01 CSCL 01/4

The PVHD is an aircraft flight attitude instrument which uses the principle that visual sensory orientation information reaches the brain via the peripheral visual pathways. The instrument is currently in a developmental stage but six workable models have been manufactured under contract for the Development of National Defence (DND) by Varian Canada Incorporated (VCI). In order to evaluate the concept under operational conditions, it was necessary to install the system in an aircraft and fly it under variable weather conditions in various types of missions. The CH 135 (Huey) helicopter was chosen for the conceptual flight trials and 403 Squadron (CFB Gagetown) was tasked to fly the system. The system was flown for approximately 35 hours by several different pilots under visual meteorological conditions, (VMC), instrument meteorological conditions (IMC), simulated instrument flying (SIF), in many missions both day and night. Daily and weekly utilization logs and reports were recorded by the pilots. At the end of the flight trial, each pilot reported his impressions on a questionnaire. Flying times under various conditions are reported along with the impressions of the pilots who flew the system. Recommendations for further operational studies are made. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N81-22051*# General Electric Co., Cincinnati, Ohio.
ENERGY EFFICIENT ENGINE FLIGHT PROPULSION SYSTEM: AIRCRAFT/ENGINE INTEGRATION EVALUATION Status Report, Jan. 1978 - Nov. 1978
R. F. Patt Jun. 1980 328 p refs
(Contract NAS3-20643)
(NASA-CR-159584; R79AEG274) Avail: NTIS
HC A15/MF A01 CSCL 21E

Results of aircraft/engine integration studies conducted on an advanced flight propulsion system are reported. Economic evaluations of the preliminary design are included and indicate that program goals will be met. Installed sfc, DOC, noise, and emissions were evaluated. Aircraft installation considerations and growth were reviewed. J.M.S.

N81-22052*# General Electric Co., Lynn, Mass.
QUIET CLEAN GENERAL AVIATION TURBOFAN (QCGAT) TECHNOLOGY STUDY, VOLUME 1 Final Report
Dec. 1975 193 p refs
(Contract NAS3-19429)
(NASA-CR-164222; R75AEG026-Vol-1) Avail: NTIS
HC A09/MF A01 CSCL 21E

The preliminary design of an engine which satisfies the requirements of a quiet, clean, general aviation turbofan (QCGAT) engine is described. Also an experimental program to demonstrate performance is suggested. The T700 QCGAT engine preliminary design indicates that it will radiate noise at the same level as an aircraft without engine noise, have exhaust emissions within the EPA 1981 Standards, have lower fuel consumption than is available in comparable size engines, and have sufficient life for five years between overhauls. M.G.

N81-22053*# General Electric Co., Evendale, Ohio.
DESIGN CONCEPTS FOR LOW-COST COMPOSITE TURBOFAN ENGINE FRAME Final Report
S. C. Mitchell and L. J. Stoffer Oct. 1980 70 p refs
(Contract NAS3-22160)
(NASA-CR-165217; R81AEG311) Avail: NTIS
HC A04/MF A01 CSCL 21E

Design concepts for low cost, lightweight composite engine frames were applied to the design requirements for the frame of a commercial, high bypass engine. Four alternative composite frame design concepts identified which consisted of generic type components and subcomponents that could be adapted to use in different locations in the engine and the different engine sizes. A variety of materials and manufacturing methods were projected with a goal for the lowest number of parts at the lowest possible cost. After a preliminary evaluation of all four frame concepts, two designs were selected for an extended design and evaluation which narrowed the final selection down to one frame that was significantly lower in cost and slighty lighter than the other frame. An implementation plan for this lowest cost frame is projected for future development and includes prospects for reducing its weight with proposed unproven, innovative fabrication techniques. Author

N81-22054*# National Aeronautics and Space Administration, Washington, D. C.
PROCEDURE FOR PRESSURE CONTACT ON HIGH-POWER SEMICONDUCTOR DEVICES FREE OF THERMAL FATIGUE Final Report
Joachim Knobloch Dec. 1979 20 p refs Transl. into ENGLISH of "Verfahren zur lastwechselfesten Druckkon-taktie-rung an Leistungs-Halbleiter-Bauelementen" BMFT-FB-T-78-02 Bundesministerium fuer Forschung und Technologie, Bonn, Nov. 1978 p 1-29 Translation was announced as N79-27418 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Brown, Boveri and Cie, A.G., Lampertheim
(Contract NASw-3199)
(NASA-TM-75733; BMFT-FB-T-78-02) Avail: NTIS
HC A02/MF A01 CSCL 21E

To eliminate thermal fatigue, a procedure for manufacturing semiconductor power devices with pure pressure contact without solid binding was developed. Pressure contact without the use of a solid binding to avoid a limitation of the maximum surface in the contact was examined. A silicon wafer covered with a relatively thick metal layer is imbedded with the aid of a soft silver foil between two identically sized hard contact discs (molybdenum or tungsten) which are rotationally symmetrical. The advantages of this concept are shown for large diameters. The pressure contact was tested successfully in many devices in a large variety of applications. E.A.K.

N81-22055*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPONENT RESEARCH FOR FUTURE PROPULSION SYSTEMS
C. L. Walker, G. J. Weden, and J. Zuk 1981 16 p refs Presented at Fifty-seventh Specialists' Meeting, Toulouse, 11-14 May 1981; sponsored by AGARD Prepared in cooperation with NASA. Ames Research Center and Army Aviation Research and Development Command, Cleveland, Ohio
(NASA-TM-82613; AVRADCOM-TR-81-C-12) Avail: NTIS

HC A02/MF A01 CSCL 21E

Factors affecting the helicopter market are reviewed. The trade-offs involving acquisition cost, mission reliability, and life cycle cost are reviewed, including civil and military aspects. The potential for advanced vehicle configurations with substantial improvements in energy efficiency, operating economics, and characteristics to satisfy the demands of the future market are identified. Advanced propulsion systems required to support these vehicle configurations are discussed, as well as the component technology for the engine systems. Considerations for selection of components in areas of economics and efficiency are presented. S.F.

N81-22056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMAL AND FLOW ANALYSIS OF A CONVECTION AIR-COOLED CERAMIC COATED POROUS METAL CONCEPT FOR TURBINE VANES

Francis S. Stepka 1981 12 p refs Presented at the 20th Natl. Heat Transfer Conf., Milwaukee, 2-5 Aug. 1981; sponsored by the ASME and the American Inst. of Chemical Engineers

(NASA-TM-81749; E-815) Avail: NTIS HC A02/MF A01 CSCL 21E

The heat transfer and pressure drop through turbine vanes made of a sintered, porous metal coated with a thin layer of ceramic and convection cooled by spanwise flow of cooling air were analyzed. The analysis was made to determine the feasibility of using this concept for cooling very small turbines, primarily for short duration applications such as in missile engines. The analysis was made for gas conditions of approximately 10 and 40 atm and 1644 K and with turbine vanes made of felt type porous metals with relative densities from 0.2 to 0.6 and ceramic coating thicknesses of 0.076 to 0.254 mm. J.M.S.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-22057 Dayton Univ., Ohio.

MAXIMUM LIKELIHOOD IDENTIFICATION OF AIRCRAFT LATERAL PARAMETERS WITH UNSTEADY AERODYNAMIC MODELLING Ph.D. Thesis

Siva Subrahmanyam Banda 1980 198 p

Avail: Univ. Microfilms Order No. 8107428

A simplified aerodynamic force and moment model for unsteadiness in the sideslipping flight was developed via an indicial sidewash function and an indicial sideforce function. The presence of convolution integrals in the equations of motion led to the Fourier transformation of these equations into the frequency domain. A parameter extraction algorithm based on the maximum likelihood estimation technique was developed in the frequency domain. This algorithm was applied to pseudo data as well as real flight data. The results indicated that, for the cases considered, inclusion of unsteady aerodynamics showed significant difference in some of the parameters, in various flights. The parameters extracted whowed less variation for different control inputs when unsteady aerodynamic modelling was included in the extraction algorithm. Dissert. Abstr.

N81-22058 Princeton Univ., N. J.

THE DEVELOPMENT OF A THEORETICAL AND EXPERIMENTAL MODEL FOR THE STUDY OF ACTIVE SUPPRESSION OF WING FLUTTER Ph.D. Thesis

David Eric Dashcund 1981 432 p

Avail: Univ. Microfilms Order No. 8108087

A wind tunnel model was used to study active suppression of classical bending torsion wing flutter using feedback control. Modeling the unsteady aerodynamics in the Laplace domain in terms of an irrational, exact representation of the generalized Theodorsen's function shows the presence of additional stability roots of the system which are not associated with the structural modes of the system nor with the feedback compensation or control surface actuator dynamics. A set of open loop system equations can be formulated from the derived closed loop system equations. Use of a rational, Pade approximation of the unsteady aerodynamics then permits the application of either classical control theory or state vector methods to feedback flutter control system synthesis and optimization. The model is applicable to a study of the effect of various active control system parameters such as control surface size and location, wing motion sensor and its location, feedback control law, feedback compensation, and actuator dynamics. Dissert. Abstr.

N81-22059*# Honeywell Systems and Research Center, Minneapolis, Minn.

F-8C ADAPTIVE CONTROL LAW REFINEMENT AND SOFTWARE DEVELOPMENT Final Report, Jun. 1976 - Jun. 1977

Gary L. Hartmann and Gunter Stein Apr. 1981 184 p refs (Contract NAS4-2344)

(NASA-CR-163093; HONEYWELL-77SRC53) Avail: NTIS HC A09/MF A01 CSCL 01C

An explicit adaptive control algorithm based on maximum likelihood estimation of parameters was designed. To avoid iterative calculations, the algorithm uses parallel channels of Kalman filters operating at fixed locations in parameter space. This algorithm was implemented in NASA/DFRC's Remotely Augmented Vehicle (RAV) facility. Real-time sensor outputs (rate gyro, accelerometer, surface position) are telemetered to a ground computer which sends new gain values to an on-board system. Ground test data and flight records were used to establish design values of noise statistics and to verify the ground-based adaptive software. T.M.

N81-22060*# National Aeronautics and Space Administration, Washington, D. C.

A DIGITAL-ANALOG HYBRID SYSTEM AND ITS APPLICATION TO THE AUTOMATIC FLIGHT CONTROL SYSTEM SIMULATION RESEARCH

Jan. 1981 23 p refs Transl. into ENGLISH of "Shu-mo hun-he xi-tong ji chi jai zi-dong feishin kong-zhi xi-tong fang-jan yen-jiu jun de ying-yung" Rept. HK-80072 Communist China, Aug. 1980 9 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Chinese Academy of Aeronautics, Communist China

(Contract NASw-3198)

(NASA-TM-76457; HK-80072) Avail: NTIS HC A02/MF A01 CSCL 01C

The characteristics of a digital-analog hybrid system composed of a DJS-8 digital computer and a HMJ-200 analog computer are described as well as its applications to simulation research for an automatic flight control system. A hybrid computational example is included to illustrate the application. A.R.H.

N81-22400*# Lockheed-Georgia Co., Marietta.

HIGH FREQUENCY DRIVE MECHANISM FOR AN ACTIVE CONTROLS SYSTEMS AIRCRAFT CONTROL SURFACE

Hugh E. Smith *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 173-188 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N81-22061*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DESCRIPTION OF 0.186-SCALE MODEL OF HIGH-SPEED DUCT OF NATIONAL TRANSONIC FACILITY

Carl L. Gentry, Jr., William B. Igoe, and Dennis E. Fuller May 1981 49 p refs

(NASA-TM-81949; L-13523) Avail: NTIS HC A03/MF A01

CSCL 14B

The National Transonic Facility (NTF) is a pressurized cryogenic wind tunnel with a 2.5 m square test section. A 0.186-scale model of the NTF was used to simulate the aerodynamic performance of the components of the high-speed duct of the NTF. These components consist of a wide-angle diffuser, settling chamber, contraction section, test section, model support section, and high-speed diffuser. The geometry of the model tunnel, referred to as the diffuser flow apparatus is described, and some of its operating characteristics are presented. Author

N81-22062# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
EVALUATION OF VIBRATORY ROLLERS FOR BOMB DAMAGE REPAIR Final Report, Oct. 1978 - Sep. 1979
Kenneth J. Knox Aug. 1980 72 p refs
(AF Proj. 2054)
(AD-A096534; AFESC/ESL-TR-80-43) Avail: NTIS HC A04/MF A01 CSCL 13/3

Four vibratory rollers in the 8.5 to 17-ton range were evaluated for use in bomb damage repair of airfields. The rollers were tested for their compaction ability on grade crushed limestone. After this initial testing the two most promising rollers were tested by repairing simulated bomb craters using 24-inch thick layers of crushed limestone compacted only from the surface. These repairs were tested with F-4 loadcraft traffic. Despite difficulties in predicting roller performance, 10-ton vibratory rollers or heavier are capable of compacting crushed limestone from the surface only to support F-4 loads. GRA

N81-22063# Aeronautical Research Labs., Melbourne (Australia).
APPLICATION OF COMPUTER COLOUR RASTER DISPLAYS IN THE COCKPIT IN RESEARCH FLIGHT SIMULATION
H. A. Thelander Mar. 1980 40 p refs
(AD-A096542; ARL/SYS-71; AR-001-798) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes an experimental investigation of the factors influencing the use of computer driven color raster displays for the provision of cockpit displays and instrumentation in manned flight simulation research. Cockpit information presentation requirements and raster display methods are discussed. The findings of the study are that the method has applicability to research simulaton, with economic advantages over the conventional approach. The main factors affecting its use are quantified. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-22064* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 4
Jan. 1981 103 p
(NASA-SP-7046(04)) Avail: NTIS HC $9.50 CSCL 22A

This bibliography lists 259 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1, 1980 and December 31, 1980. Its purpose is to provide information to the researcher, manager, and designer in technology development and mission design in the area of the Large Space Systems Technology Program. Subject matter is grouped according to systems, interactive analysis and design. Structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, solar power satellite systems, and flight experiments. Author

N81-22065*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIALS PROCESSING IN SPACE (MPS) PROGRAM DESCRIPTION
Apr. 1981 85 p refs
(NASA-TM-82410) Avail: NTIS HC A05/MF A01 CSCL 22A

Insight is provided into the scientific rotationale for materials processing in space (MPS), and a comprehensive and cohesive approach for implementation and integration of the many, diverse aspects of MPS is described. The programmatic and management functions apply to all projects and activities implemented under MPS. It is intended that specific project plans, providing project unique details, will be appended to this document for endeavors such as the Space Processing Applications Rocket (SPAR) Project, the Materials Experiment Assembly (MEA) Project, the MPS/Spacelab (MPS/SL) Project, and the Materials Experiment Carrier (MEC) Payloads. S.F.

N81-22066# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.
COLLISION HAZARD IN SPACE Final Report
V. A. Chobotov 25 Feb. 1981 68 p refs
(Contract F04701-80-C-0081)
(AD-A097004; TR-0081(6790)-1; SD-TR-81-11) Avail: NTIS CSCL 12/1

The statistical data on the known orbiting population of objects is presented and analyzed. Several methods for determining the probability of collision in orbit are described. Collision probabilities for low and geosynchronous orbits are evaluated. Potential operational and design policies for reducing the collision hazard and minimizing the proliferation of debris in space are examined. GRA

N81-22067# Battelle Inst., Frankfurt am Main (West Germany).
DISPERSION ELECTROLYSIS UNDER ZERO GRAVITY UNDER THE SPACELAB ROCKET PROGRAM TEXUS 1 Final Report
Josef Ehrhardt Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-30; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

The experiment concerns the electrodeposition of a nickel layer with incorporated Al2O3 particles from a sulphamate electrolyte during a zero-gravity phase of 6 minutes. Contrary to the layer deposited at 1 g, the layer deposited at zero gravity shows a network of cracks; the extent of these cracks decreases with decreasing current density. An explanation of this phenomenon could not be found. An additional observation is that the deep dispersion of the electrolyte is much better at zero gravity than under the influence of the earth as gravity. Author (ESA)

N81-22395*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COALIGNMENT OF SPACECRAFT EXPERIMENTS
Robert E. Federline *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 91-113 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N81-22068*# Texas Univ. at Arlington. Inst. for Advanced Study in Orbital Mechanics.
MULTISTEP INTEGRATION FORMULAS FOR THE NUMERICAL INTEGRATION OF THE SATELLITE PROBLEM
John B. Lundberg and Byron D. Tapley Apr. 1981 146 p refs
(Grant NGR-44-012-283)
(NASA-CR-164193; IASOM-81-1) Avail: NTIS HC A07/MF A01 CSCL 22A

The use of two Class 2/fixed mesh/fixed order/multistep integration packages of the PECE type for the numerical integration of the second order, nonlinear, ordinary differential equation of the satellite orbit problem. These two methods are referred to as the general and the second sum formulations. The derivation of the basic equations which characterize each formulation and the role of the basic equations in the PECE algorithm are discussed.

Possible starting procedures are examined which may be used to supply the initial set of values required by the fixed mesh/multistep integrators. The results of the general and second sum integrators are compared to the results of various fixed step and variable step integrators. M.G.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N81-22068*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Radar and RF Subsystems.
SCIENCE AND APPLICATIONS SPACE PLATFORM (SASP) END-TO-END DATA SYSTEM STUDY Final Report
P. R. Crawford and L. H. Kasulka Apr. 1981 80 p refs (Contract NAS8-33592)
(NASA-CR-161753; MDC-G9372) Avail: NTIS HC A05/MF A01 CSCL 22B

The capability of present technology and the Tracking and Data Relay Satellite System (TDRSS) to accommodate Science and Applications Space Platforms (SASP) payload user's requirements, maximum service to the user through optimization of the SASP Onboard Command and Data Management System, and the ability and availability of new technology to accommodate the evolution of SASP payloads were assessed. Key technology items identified to accommodate payloads on a SASP were onboard storage devices, multiplexers, and onboard data processors. The primary driver is the limited access to TDRSS for single access channels due to sharing with all the low Earth orbit spacecraft plus shuttle. Advantages of onboard data processing include long term storage of processed data until TRDSS is accessible, thus reducing the loss of data, eliminating large data processing tasks at the ground stations, and providing a more timely access to the data. J.M.S.

N81-22397*# Martin Marietta Aerospace, Denver, Colo.
SPACE DEPLOYABLE TRUSS STRUCTURE DESIGN
John V. Coyner, Jr. and William H. Tobey *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 137-146 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

N81-22398*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE DESIGN OF LARGE SPACE DEPLOYABLE MODULAR ANTENNA REFLECTORS
J. W. Ribble and A. A. Woods, Jr. *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 147-157 ref (For primary document see N81-22388 13-39)
(Contract NAS1-14887)
Avail: NTIS HC A19/MF A01 CSCL 22B

N81-22399*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE TECHNOLOGY DEVELOPMENT METHODOLOGY FOR A CLASS OF LARGE DIAMETER SPACEBORNE DEPLOYABLE ANTENNAS
William D. Wade and Verdinal C. McKean *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 159-172 refs (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

N81-22412*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPARATIVE EVALUATION OPERABILITY OF LARGE SPACE STRUCTURE CONNECTORS
Jack Stokes *In its* The 15th Aerospace Mech. Symp. May 1981 p 357-374 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

N81-22414*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACECRAFT AUTOMATIC UMBILICAL SYSTEM
R. W. Goldin (Lockheed Missiles and Space Co.), G. G. Jacquemin (Lockheed Missiles and Space Co.), and W. H. Johnson *In its* The 15th Aerospace Mech. Symp. May 1981 p 391-421 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22D

N81-22415*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE LONG DURATION EXPOSURE FACILITY STRUCTURAL INTERFACE
Moses J. Long *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 423-439 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-22070*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LAUNCH MISSION SUMMARY: INTELSAT 5(F1) ATLAS/CENTAUR-56
1 May 1981 14 p refs
(NASA-TM-82338; KSC-GP-15-17) Avail: NTIS HC A02/MF A01 CSCL 22A

The technology and capability of the INTELSAT 5 series satellites and the Atlas-Centaur launch vehicle are described. Data relative to launch windows, flight plans, radar, and telemetry are included along with selected trajectory information and a sequence of flight events. A.R.H.

N81-22071*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPACE SHUTTLE ORBITER TRIMMED CENTER-OF-GRAVITY EXTENSION STUDY. VOLUME 7: EFFECTS OF CONFIGURATION MODIFICATIONS ON THE SUBSONIC AERODYNAMIC CHARACTERISTICS OF THE 1140 A/B ORBBITER AT HIGH REYNOLDS NUMBERS
W. Pelham Phillips Mar. 1981 89 p refs
(NASA-TM-72661-Vol-7) Avail: NTIS HC A05/MF A01 CSCL 22B

Subsonic longitudinal andd laternal directional characteristics were obtained for several modified configurations of the 140 A/B orbiter (0.010 scale). These modifications, designed to extend longitudinal trim capability forward of the 65 percent fuselage length station, consisted of modified wing planform fillet and a canard. Tests were performed in the Langley Low Turbulence Pressure Tunnel at Reynolds numbers from about 4.2 million to 14.3 million based on the fuselage reference length. Author

N81-22072*# National Aeronautics and Space Administration, Washington, D. C.
LANDING IN THE FUTURE: BIOLOGICAL EXPERIMENTS ON EARTH AND IN SPACE ORBIT
A. Pokrovskiy Sep. 1980 11 p Transl. into ENGLISH from Pravda (Moscow), 15 Oct. 1979 p 3, columns 2-6 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76399) Avail: NTIS HC A02/MF A01 CSCL 22B

The development of an Earth biosatellite to duplicate the parameters of pressure, temperature, humidity and others in a space environment onboard Cosmos-1129 is discussed. Effects of a space environment on fruit flies, dogs, laboratory rats in procreation, behavior, stress, biorhythm, body composition, gravitation preference, and cell cultures are examined. The space environment for agricultural products is also studied. The effects of heavy nuclei of galactic space radiation on biological objects

inside and outside the satellite is studied, and methods of electrostatic protection are developed. E.A.K.

N81-22073*# National Aeronautics and Space Administration, Washington, D. C.
SOLARIS: ORBITAL STATION: AUTOMATIC LABORATORY FOR OUTER SPACE RENDEZVOUS AND OPERATIONS
J. J. Runavot Apr. 1981 31 p Transl. into ENGLISH of "Solaris Station Orbitale - Laboratoire Automatique pour le Rendezvous et les Interventions Spatiales" Rept. Centre Nationale d'Etudes Spatiales, Centre Spatiale de Toulouse (France), Toulouse, 10 Sep. 1980 p 1-27 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre Spatial de Toulouse
(Contract NASw-3199)
(NASA-TM-76403) Avail: NTIS HC A03/MF A01 CSCL 22B

The preliminary design for a modular orbital space station (unmanned) is outlined. The three main components are a support module, an experiment module, and an orbital transport vehicle. The major types of missions (assembly, materials processing, and Earth observation) that could be performed are discussed. Author

N81-22074*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOW DRAG ATTITUDE CONTROL FOR SKYLAB ORBITAL LIFETIME EXTENSION
John R. Glaese and Hans F. Kennel Apr. 1981 65 p refs
(NASA-TM-82412) Avail: NTIS HC A04/MF A01 CSCL 22A

In the fall of 1977 it was determined that Skylab had started to tumble and that the original orbit lifetime predictions were much too optimistic. A decision had to be made whether to accept an early uncontrolled reentry with its inherent risks or try to attempt to control Skylab to a lower drag attitude in the hope that there was enough time to develop a Teleoperator Retrieval System, bring it up on the Space Shuttle and then decide whether to boost Skylab to a higher longer life orbit or to reenter it in a controlled fashion. The end-on-velocity (EOVV) control method is documented, which was successfully applied for about half a year to keep Skylab in a low drag attitude with the aid of the control moment gyros and a minimal expenditure of attitude control gas. Author

N81-22075*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF A METHOD FOR REPAIRING THE HOT GAS SYSTEM BRANCH 2 OF THE SYMPHONIE-SATELLITE MV2 IN ORBIT Final Report
H. Braun Feb. 1981 105 p Transl. by "Untersuchung Einer Methode zur Reparierund des Heissgassystemzweiges II des Symphonie-Satelliten MV2 im Orbit" Rept., Ottobrun, West Germany, 13 Feb. 1978 102 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Space Div., MBB, Ottobrun, West Germany
(Contract NASw-3198)
(NASA-TM-76552) Avail: NTIS HC A06/MF A01 CSCL 22B

The failure of all engines on the Symphonie MV2 satellite is attributed to blockage of the oxidizer branch caused by metal salts precipitating and forming a gel which constricts the narrow passage. Laboratory tests and other simulations conducted to observe the behavior of artificially produced jellies on a vacuum show that a removal or at least a reduction of the blockage in the oxidizer branch is possible by evacuation. The greatest blockage appears to occur in the filter. This fact restricts the capability to perform repairs in orbit because the filter installed ahead of the valve cannot by subjected to a vacuum. A.R.H.

N81-22076*# Vought Astronautics, Dallas, Tex.
STUDY OF THERMAL CONTROL SYSTEMS FOR ORBITING POWER SYSTEMS Final Report
H. R. Howell 16 Feb. 1981 168 p refs
(Contract NAS8-33560)
(NASA-CR-161751; Rept-2-53020/1R-52666) Avail: NTIS HC A08/MF A01 CSCL 22B

Thermal control system designs were evaluated for the 25 kW power system. Factors considered include long operating life, high reliability, and meteoroid hazards to the space radiator. Based on a cost advantage, the bumpered pumped fluid radiator is recommended for the initial 25 kW power system and intermediate versions up to 50 kW. For advanced power systems with heat rejection rates above 50 kW the lower weight of the advanced heat pipe radiator offsets the higher cost and this design is recommended. The power system payloads heat rejection allocations studies show that a centralized heat rejection system is the most weight and cost effective approach. The thermal interface between the power system and the payloads was addressed and a concept for a contact heat exchanger that eliminates fluid transfer between the power system and the payloads was developed. Finally, a preliminary design of the thermal control system, with emphasis on the radiator and radiator deployment mechanism, is presented. J.M.S.

N81-22077# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SATNET DEVELOPMENT AND OPERATION; PLURIBUS SATELLITE IMP DEVELOPMENT; REMOTE SITE MAINTENANCE; INTERNET DEVELOPMENT; MOBILE ACCESS TERMINAL NETWORK; TCP FOR THE HP3000; TCP-TAC; TCP FOR VAX-UNIX Quarterly Technical Report, 1 Nov. 1980 - 31 Jan. 1981
R. D. Bressler Feb. 1981 91 p
(Contracts N00039-78-C-0405; N00039-79-C-0386; N00039-80-C-0664; MDA903-80-C-0353; MDA903-80-C-0214; MDA903-76-C-0213; MDA903-76-C-0252; F08606-75-C-0032; ARPA Order 3214; ARPA Order 3175)
(AD-A096114; BBN-4609; QTR-20) Avail: NTIS HC A05/MF A01 CSCL 17/2

This Quarterly Technical Report describes work on the development of an experimentation with packet broadcast by satellite; on development of Pluribus Satellite IMPs; on a study of the technology of Remote Site Maintenance; on the development of Inter-network monitoring; on shipboard satellite communications; and on the development of Transmission control protocols for the HP3000, TAC, and VAX-UNIX. GRA

N81-22411*# General Electric Co., Philadelphia, Pa. Space Div.
A FULLY REDUNDANT POWER HINGE FOR LANDSAT-D APPENDAGES
Frank E. Mamrol and Donald N. Matteo *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 341-355 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-22389*# Rockwell International Corp., Downey, Calif. Space Transportation System Development and Production Div.
DRIVE MECHANISM FOR THE SHUTTLE ORBITER/EXTERNAL TANK PROPELLANT DISCONNECT
E. Thomas, R. Wilders (Parker Hannifin Corp., Irvine, Calif.), and J. Ulanovsky (Parker Hannifin Corp., Irving, Calif.) *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 1-18 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

N81-22390*# Rockwell International Corp., Downey, Calif. Space Transportation System Development and Production Div.
SPACE SHUTTLE ORBITER RUDDER/SPEEDBRAKE ACTUATION SYSTEM
Dwight Woolhouse *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 19-29 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

N81-22391*# Ball Aerospace Systems Div., Boulder, Colo.
PAYLOAD RETENTION LATCHES FOR THE SHUTTLE ORBITER
Robert D. Renken and Richard P. Maxwell *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 31-46 ref (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

N81-22392*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE SHUTTLE SLIDEWIRE EMERGENCY EGRESS SYSTEM
Glenn B. Jeffcoat and Emile S. Stephan *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 47-62 refs (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-22078*# International Applied Physics, Inc., Dayton, Ohio.
THE ELECTRIC RAIL GUN FOR SPACE PROPULSION Final Report, 24 Jun. 1980 - 30 Jan. 1981
David P. Bauer, John P. Barber, and C. Julian Vahlberg Feb. 1981 160 p
(Contract NAS3-22475)
(NASA-CR-165312) Avail: NTIS HC A08/MF A01 CSCL 21H

An analytic feasibility investigation of an electric propulsion concept for space application is described. In this concept, quasistatic thrust due to inertial reaction to repetitively accelerated pellets by an electric rail gun is used to propel a spacecraft. The study encompasses the major subsystems required in an electric rail gun propulsion system. The mass, performance, and configuration of each subsystem are described. Based on an analytic model of the system mass and performance, the electric rail gun mission performance as a reusable orbital transfer vehicle (OTV) is analyzed and compared to a 30 cm ion thruster system (BIMOD) and a chemical propulsion system (IUS) for payloads with masses of 1150 kg and 2300 kg. For system power levels in the range from 25 kW(e) to 100 kW(e) an electric rail gun OTV is more attractive than a BIMOD system for low Earth orbit to geosynchronous orbit transfer durations in the range from 20 to 120 days. E.D.K.

N81-22079*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY. PHASE A, EXTENSION 1: STUDY PLAN UPDATE
J. A. Mellish 31 Jul. 1979 51 p refs
(Contract NAS8-32999)
(NASA-CR-161708; Rept-32999-SP2) Avail: NTIS HC A04/MF A01 CSCL 21H

The updated study plan for the Space Transportation System orbit transfer vehicle (OTV) engine study is presented. The study program consists of engine system, programmatic, cost, and risk analyses of OTV engine concepts. Detailed task descriptions for the advanced expander cycle engine optimization, alternate low thrust capability, and safety, reliability, and cost comparisons are given. M.G.

N81-22080*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY. PHASE A, EXTENSION 1: ALTERNATE LOW-THRUST CAPABILITY TASK REPORT
J. A. Mellish Apr. 1980 54 p refs
(Contract NAS8-32999)
(NASA-CR-161709; Rept-32999-E1-T2) Avail: NTIS HC A04/MF A01 CSCL 21H

The feasibility and design impact of a requirement for the advanced expander cycle engine to be adaptable to extended low thrust operation of approximately 1K to 2K lb is assessed. It is determined that the orbit transfer vehicle point design engine can be reduced in thrust with minor injector modifications from 15K to 1K without significantly affecting combustion performance efficiency or injector face/chamber wall thermal compatibility. Likewise, high frequency transverse mode combustion instability is not expected to be detrimentally affected. Primarily, the operational limitations consist of feed system chugging instabilities and potential coupling of the injector response with the chamber longitudinal mode resonances under certain operating conditions. The recommended injector modification for low thrust operation is a change in the oxidizer injector element orifice size. Analyses also indicate that chamber coolant flow stability may be a concern below 2K 1bF operation and oxidizer pump stability could be a problem below a 2K thrust level although a recirculation flow could alleviate the problem. M.G.

N81-22081*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY. PHASE A, EXTENSION 1: ADVANCED EXPANDER CYCLE ENGINE OPTIMIZATION
J. A. Mellish Nov. 1979 89 p refs
(Contract NAS8-32999)
(NASA-CR-161710; Rept-3299-E1-T1) Avail: NTIS HC A05/MF A01 CSCL 21H

The performance optimization of expander cycle engines at vacuum thrust levels of 10K, 15K, and 20K lb is discussed. The optimization is conducted for a maximum engine length with an extendible nozzle in the retracted position of 60 inches and an engine mixture ratio of 6.0:1. The thrust chamber geometry

and cycle analyses are documented. In addition, the sensitivity of a recommended baseline expander cycle to component performance variations is determined and chilldown/start propellant consumptions are estimated. M.G.

N81-22082*# National Aeronautics and Space Administration, Washington, D. C.
TEST REPORT ON THE 75-MINUTE HOT RUN OF THE 400N ENGINE AS PART OF THE PRELIMINARY QUALIFICATION WITH THE MODIFIED SYMPHONIE PROJECT ENGINE
Lampoldshausen Feb. 1981 101 p Transl. into ENGLISH of "Pruefbericht 75 min Heisslauf 400N Triebwerk im Rahmen der Qualifikation mit dem Modifizierten Symphonie Triebwerk" Rept. RPM-TR1400-0401 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrun, 10 Jan. 1980 101 p Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76538; RPM-TR1400-0401) Avail: NTIS HC A06/MF A01 CSCL 21H

The influence of long term operation on the geometry of the engine was studied and visual observations of the engine after the hot run were made. The 400 N engine was operated for 4560 sec, or 76 minutes, at an ambient pressure of 1.45 m bar. There was a nominal mass through put of 133 g/s, and a mixture ratio of 1.625 of He saturated MON-1 fuel and MMH. The fuel and oxidizer were pressurized at 17.3 bar, and were at a temperature of 20 C. T.M.

N81-22083*# National Aeronautics and Space Administration, Washington, D. C.
TEST REPORT: LONG-TIME QUALIFICATION FOR THE 400 N ENGINE BLOCKING UNIT (TEST CONFIGURATION JOP 113)
Weigelt Feb. 1981 45 p Transl. into ENGLISH of "Prufbericht, Langzeitqualifikation, Absperreinheit 400 N-Triebwerk (Testaufbau JOP 113)" Rept. RPM-TR400-16-01 Ottobrum, West Germany, 25 Feb. 1980 44 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by MBB GmbH, Ottobrum, West Germany
(NASA-TM-76544; RPM-TR400-16-01) Avail: NTIS HC A03/MF A01 CSCL 21H

Results of the long-time qualification tests using a blocking unit of the 400 N-engine are presented. The configuration of this blocking unit was already used successfully unchanged both in the ELDO-40 kp control engine as well as in the SYMPHONIE 400 N-apogee engine, but only for times up to a maximum of 20 min. The test was carried out within the framework of the long-time qualification test. It was to be demonstrated that the blocking unit of the 400 N-engine satisfies the requirements for interplanetary long-time missions. Emphasis was placed on compatibility of materials and perfect operation of the blocking unit for the long-time effect of 200 days with the fuel combination MON-1 (nitrogen tetroxide + 0.8% nitrogen oxide - MMH (monomethylhydrazine) and the control medium helium, enriched with the vapros of the two fuels. J.M.S.

N81-22084*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARTICLE AND FIELD MEASUREMENTS ON TWO J-SERIES 30 CENTIMETER THRUSTERS
Walter C. Lathem 1981 27 p refs Presented at the 15th Intern. Elec. Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981; sponsored by AIAA, Japan Society for Aeronautical and Space Sciences and DGLR
(NASA-TM-81741; E-794) Avail: NTIS HC A03/MF A01 CSCL 21H

Tests were performed to characterize the particles and fields associated with two 30 cm mercury ion thrusters operating independently and simultaneously. Flux rates and energies of ions and their distribution around the thrusters were determined. Facility effect ions were measured and their effect on thruster created flux measurements was assessed. The flux rate and distribution of sputtered metal atoms was determined and compared with theory and previous measurements. Mapping of the potential fields in the near vicinity of the thrusters was accomplished. Author

N81-22085# Naval Weapons Center, China Lake, Calif.
FUEL-RICH PLUME COMBUSTION Annual Progress Report, 1 Oct. 1979 - 30 Sep. 1980
K. C. Schadow 30 Sep. 1980 8 p refs
(AD-A096808) Avail: NTIS HC A02/MF A01 CSCL 21/5

This program will investigate the mixing, ignition, and combustion of a primary fuel-rich plume, with and without particulate fuels, in a secondary subsonic airstream. The purpose is to obtain a basic understanding of these phenomena to permit application to ramjets. GRA

N81-22086# Naval Weapons Center, China Lake, Calif.
ENERGY CONTRIBUTIONS ASSOCIATED WITH COMBUSTION INSTABILITY Annual Progress Report, 1 Oct. 1979 - 30 Sep. 1980
H. B. Mathes 30 Sep. 1980 5 p
(AD-A096806) Avail: NTIS HC A02/MF A01 CSCL 21/8

The investigation of new and novel laboratory test techniques for determining the acoustic energy contributions of burning propellants will be pursued. Emphasis will be on methods that provide a more direct measurement than presently employed. Initial effort will be focused on methods for directly determining the response of solid propellant combustion to incident acoustic pressure waves. If successful, the method, or methods, for pressure-coupled measurement will be modified to provide direct velocity-coupled response measurements. These methods are expected to lower the cost of characterizing the acoustic combustion response of solid propellant formulations of interest to the Navy and to provide improved accuracy of measurement. GRA

N81-22087# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
CONTAMINATION MEASUREMENTS DURING THE FIRST VACUUM TEST OF THE LARGE IUS SOLID PROPELLANT MOTOR Interim Report
E. N. Borson and R. V. Peterson 15 Jan. 1981 55 p refs
(Contract F04701-80-C-0081)
(AD-A096996; TR-0081(6464-02)-1; SD-TR-80-86) Avail: NTIS HC A04/MF A01 CSCL 21/8

The plume contamination monitoring experiment of the IUS motor test conducted 19 December 1977 at AEDC consisted of several specimen witness plates that were placed in four sample canisters located around the rocket motor plume boundary. In this report are described the contamination sampling methods and the analytical results obtained from the plume sampling of the IUS motor test. Recommendations for future contamination monitoring of IUS tests are also given. There is a potential contamination problem from the IUS firings as submicrometer to several tens of micrometer diameter particles were found on the specimen witness plates. The shape and composition of the particles varied widely but were mainly spherical in shape containing carbon, aluminum, or silicon. A molecular film was also present on many of the witness plates. GRA

N81-22396*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ZERO GRAVITY TESTING OF FLEXIBLE SOLAR ARRAYS
D. T. Chung and L. E. Young *In its* The 15th Aerospace Mech. Symp. May 1981 p 115-136 refs Prepared in cooperation with Lockheed Missiles and Space Co., Sunnyvale, Calif. (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 21C

N81-22407*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SRB DEWATERING SET
Robert E. Wickham *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 279-289 refs (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 21H

N81-22408*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE MAIN ENGINE: HYDRAULIC SYSTEM
Gerhard Geller and Carl D. Lamb *In its* The 15th Aerospace Mech. Symp. May 1981 p 291-301 (For primary document

see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-22088 Tennessee Univ., Knoxville.
BEHAVIOR OF AROMATIC CATIONS AND RADICALS IN STRONG ACID MEDIA Ph.D. Thesis
Robert Julian Smith 1980 155 p
Avail: Univ. Microfilms Order No. 8108172

The possibility that aromatic free radicals may undergo electrophilic aromatic substitution (EAS) reactions was investigated. Some hydride abstraction reactions are believed to occur by a step wise electron transfer mechanism. One step of such a mechanism is deprotonation of a radical cation to form a free radical and there is evidence that this step is reversible. Attempts were made to illustrate this reverse reaction by treating the phenalenyl radical and the 2,2',2', 6,6',6' hexamethoxytriphenylmethyl radical with strong, nonoxidizing acids. Neither compound was shown unequivocally to undergo this reaction. Aryl nitroxides also did not undergo EAS reactions in strong acids.
Dissert. Abstr.

N81-22089 Ohio State Univ., Columbus.
A KINETIC-ELASTIC APPROACH FOR TIME-DEPENDENT RHEOLOGICAL DATA Ph.D. Thesis
Keon Yang Park 1980 420 p
Avail: Univ. Microfilms Order No. 8107376

The Kinetic-Elastic approach was developed to describe non-Newtonian viscoelastic phenomena. Modification of the original one-step kinetic reaction concept to a two-step complex reaction concept was introduced. This part of the development is called the kinetic model for thixotropic change. A study of the effect of the parameters of the Kinetic-Elastic theory for the stress growth experiment is an essential part of the optimization procedure. The results of the parametric study of theory shows that the equilibrium stress level is lowered by an increase in K sub A, P sub A, K sub B and P sub B. The initial slope is controlled only by G sub 1. The peak maximum is increased with a decrease in P sub 1 and K sub 1. The peak is shifted horizontally towards the origin with an increase in P sub 4 and k sub 4. K sub 3 and k sub 6 have no significant effect within the range of 0 to 100 and 0 to 10, respectively. The optimization of constants was accomplished using an interactive procedure utilizing modern computer graphics. Dissert. Abstr.

N81-22090# Arizona Univ., Tucson. Dept. of Chemistry.
IMPROVED SYNTHESES OF BENZILS Final Report, 1 Jul. 1979 - 31 Jul. 1980
Stephen Havens, C. C. Yu, and C. S. Marvel Wright-Patterson AFB, Ohio AFWAL Dec. 1980 23 p refs
(Contract F33615-79-C-5103)
(AD-A096767; AFWAL-TR-80-4180) Avail: NTIS HC A02/MF A01 CSCL 07/3

Three approaches were investigated to obtain a general method of synthesis of low-cost bis-benzil monomers for use in quinoxaline resin systems. Reaction of phenylmagnesium bromide with iron carbonyl and acid chlorides was unsuccessful. Reaction of acid chlorides with benzylidene triphenylphosphorane followed by periodate oxidation proved successful. Palladium catalyzed conversion of dibromoaromatics to bis-acetylenes followed by permanganate oxidation also proved successful. The scope of these reactions was explored. GRA

N81-22091# California Univ., Livermore. Lawrence Livermore Lab. Metals and Ceramics Div.
ADVANCES IN MATERIALS SCIENCE, METALS AND CERAMICS DIVISION Triannual Progress Report, Jun. - Sep. 1980
J. J. Truhan, ed., R. W. Hopper, ed., and K. M. Gordon, ed. 28 Oct. 1980 37 p refs
(Contract W-7405-eng-48)
(UCRL-50058-80-3) Avail: NTIS HC A03/MF A01

Information is presented concering the magnetic fusion energy program, the laser fusion energy program, geothermal research, and nuclear waste management. Other topics include diffusion in silicate minerals, chemistry research resources, and chemistry and materials science research. DOE

N81-22092# Battelle Pacific Northwest Labs., Richland, Wash.
MUTAGENIC AND CHEMICAL PROPERTIES OF SRC-1 MATERIALS Progress Report, 1 Mar. 1980 - 28 Feb. 1981
R. A. Pelroy, ed., D. S. Sklarew, A. Toste, and B. W. Wilson Jan. 1981 33 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3604) Avail: NTIS HC A03/MF A01

Process solvent (PS) and solid product (dissolved in organic solvent) produced by the solvent refined coal (SRC-I) process contain mutagenically active components against the Ames-Salmonella strains, Salmonella typhimurium TA98 and TA100. Ames positive mutagens are apparently concentrated in the moderately polar to strongly polar chemical constituents of both materials. However, the dissolved solid product contains a much higher proportion of very strongly polar mutagens, and may be enriched in acidic, i.e., oxygen containing mutagens. DOE

N81-22093# California Univ., Livermore. Lawrence Livermore Lab.
UTILIZATION OF OIL SHALES AND BASIC RESEARCH IN ORGANIC GEOCHEMISTRY
A. K. Burnham 13 Jan. 1981 15 p refs
(Contract W-7405-eng-48)
(UCID-18891) Avail: NTIS HC A02/MF A01

Research needs relating to oil shale utilization which might also provide insight into the organic geochemistry of the Green River formation are discussed. Two general topics cross boundaries and are worthy of emphasis. The first is a study of changes in the kerogen structure and biological markers with depth and location, and how these changes affect the pyrolysis products. The second is a study of the heteroatom chemistry of the kerogen and how it relates to mineral matter and trace metals. This would be useful not only to present utilization methods, but also might suggest new nonthermal methods of organic materials recovery. DOE

N81-22094# KMS Fusion, Inc., Ann Arbor, Mich.
IN-SITU SEEDING OF HI-Z ELEMENTS IN GLOW DISCHARGE POLYMERIZED ORGANIC COATINGS
R. L. Crawley, L. B. Kool, and R. L. Nolen 1980 10 p refs Presented at the Am. Vacuum Soc. Conf., Detroit, 13 Oct. 1980
(Contract DE-AC08-78DP-40030)
(KMSF-U-1008; CONF-801037-26) Avail: NTIS HC A02/MF A01

Currently favored inertial fusion target designs include low anti Z coatings seeded with small amounts of hi-Z elements. Methods for incorporating hi-Z elements into glow discharge polymerized (GDP) coatings are investigated. In the first method an iodine was substituted onto the p-xylene molecule prior to GDP deposition. Chemical analysis, IR, and NMR of the resultant coating indicate up to 7 at, % iodine chemically incorporated. Other methods include ion implantation and GDP/sputtering codeposition. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N81-22095 Georgia Inst. of Tech., Atlanta.
BEHAVIOR OF CONTINUOUS FILAMENT ADVANCED COMPOSITE ISOGRID STRUCTURE Ph.D. Thesis
Ambur Damodara Reddy 1980 110 p
Avail: Univ. Microfilms Order No. 8107287

To realize the full potential of continuous filament advanced composite isogrid (CPACI), basic data on the load bearing structure must be acquired and evaluated in conjunction with current theoretical models and analysis methods. The data base established through such an effort is of great importance in

order to inspire confidence in the use of the concept. Both strength and stiffness controlled behavior was studied. Three large panels were tested previously as wide columns in uniaxial compression with fixed loaded ends. A variety of element tests including assessment of fiber content are performed to determine a maximum of information from the three original panels. The experimental data obtained are self consistent and show good agreement with theoretical predictions. The pronounced effect of transverse shear flexibility is evident in the bend tests and in the correlation of buckling data. The scaling law suggested is useful as buckling tests of complex structures may sometimes be avoided. Manufacturing inconsistencies are clearly identified as the primary reason for the scatter in test data. Dissert. Abstr.

N81-22096*# National Aeronautics and Space Administration, Washington, D. C.

PULL-OUT FIBERS FROM COMPOSITE MATERIALS AT HIGH RATE OF LOADING

S. Amijima and T. Fujii Mar. 1981 18 p refs Transl. into ENGLISH from Japan Soc. Mater. Sci. (Japan), v. 28, Nov. 1979 p 1091-1097 Presented at the 5th Symp. on FRP, 31 May 1979; sponsored by the Japan Society of Material Science Original language document was announced as A80-19909 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Doshisha Univ., Kyoto, Japan and Japan Defense Agency, Sagamihera
(Contract NASw-3198)
(NASA-TM-76530) Avail: NTIS HC A02/MF A01 CSCL 11D

Numerical and experimental results are presented on the pullout phenomenon in composite materials at a high rate of loading. The finite element method was used, taking into account the existence of a virtual shear deformation layer as the interface between fiber and matrix. Experimental results agree well with those obtained by the finite element method. Numerical results show that the interlaminar shear stress is time dependent, in addition, it is shown to depend on the applied load time history. Under step pulse loading, the interlaminar shear stress fluctuates, finally decaying to its value under static loading. Author

N81-22097*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF PREPARATION CONDITIONS ON THE STRUCTURE AND MECHANICAL PROPERTIES OF REACTION-SINTERED SILICON NITRIDE

Juergen Heinrich Apr. 1980 103 p refs Transl. into ENGLISH of "Der Einfluss von Herstellungsbedingungen auf das Fefuege und die Mechanishchen Eigenschaften von Reaktionsgesintertem Siliciumnitrid" Rept. DFVLR-FB-79-32, Cologne, 12 Sep. 1979 102 p Translation was announced as N80-24383 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by DFVLR, Cologne
(Contract NASw-3198)
(NASA-TM-75797; DFVLR-FB-79-32) Avail: NTIS HC A06/MF A01 CSCL 11D

The microstructure of reaction sintered silicon nitride (RSSN) was changed over a wide range by varying the grain density, grain size of the silicon starting powder, nitriding conditions, and by introducing artificial pores. The influence of single microstructural parameters on mechanical properties like room temperature strength, creep behavior, and resistance to thermal shock was investigated. The essential factors influencing these properties were found to be total porosity, pore size distribution, and the fractions of alpha and beta Si3N4. In view of high temperature engineering applications of RSSN, potentials for optimizing the material's properties by controlled processing are discussed. E.D.K.

N81-22098*# National Aeronautics and Space Administration, Washington, D. C.

EROSION RESISTANT COATINGS

Leonello Falco and Alessandro Cushini Jan. 1981 14 p refs Transl. into ENGLISH from Proc. Assoc. Ital. di Aeron. Astronautics (Turin), v. 1, 1979 p 335-344 Presented at the 3rd Natl. Congr. Assoc. Ital. di Aeron. e Astronautics, Turin, 30 Sep. - 3 Oct. 1975 Original language document was announced as A78-19056 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Univ. Levrotto e Bella, Italy
(Contract NASw-3198)
(NASA-TM-75870) Avail: NTIS HC A02/MF A01 CSCL 11D

Apparatus for measuring the resistance of materials to erosion is examined and a scheme for standardization of the test parameters is described. Current materials being used for protecting aircraft parts from erosion are surveyed, their chief characteristics being given. The superior properties of urethane coatings are pointed out. The complete cycle for painting areas subject to erosion is described. Author

N81-22099*# National Aeronautics and Space Administration, Washington, D. C.

PROCESS FOR THE MANUFACTURE OF CARBON OR GRAPHITE FIBERS

D. Overhoff, E. Winkler, and D. Mueller Jun. 1979 11 p Transl. into ENGLISH of West German patent disclosure no. 2,220,614 (8 Nov. 1973) Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Sigri Elektrographit GmbH, Meitingen, West Germany
(Contract NASw-3199)
(NASA-TM-75467) Avail: NTIS HC A02/MF A01 CSCL 11D

Carbon or graphite fibers are manufactured by heating polyacrylonitrile fiber materials in various solutions and gases. They are characterized in that the materials are heated to temperatures from 150 to 300 C in a solution containing one or more acids from the group of carbonic acids, sulfonic acids, and/or phenols. The original molecular orientation of the fibers is preserved by the cyclization that occurs before interlacing, which gives very strong and stiff carbon or graphite fibers without additional high temperature stretching treatments. E.A.K.

N81-22100# Naval Research Lab., Washington, D. C.

THERMAL RESPONSE OF GRAPHITE EPOXY COMPOSITE SUBJECTED TO RAPID HEATING

C. A. Griffis, R. A. Masumura, and C. I. Chang 31 Mar. 1981 23 p refs
(ZF61544007)
(AD-A096898; NRL-MR-4479) Avail: NTIS HC A02/MF A01 CSCL 11/4

A one-dimensional finite difference analysis describing the transient thermal response of fiber-reinforced organic matrix composite plates subjected to intense surface heating is presented. The effects of fiber ablation, matrix decomposition, and radiation and convective heat losses are included in the formulation. Numerical results are in good agreement with mass loss and thermocouple measurements obtained from laser irradiation tests on AS/3501-6 graphite epoxy coupons. A steady state analytic solution is also given which provides a reasonable estimate of the surface recession rate over much of the surface irradiation period. GRA

N81-22101# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.

THE RELATIONSHIP BETWEEN TENSILE STRENGTH AND FLEXURE STRENGTH IN FIBER REINFORCED COMPOSITES Interim Report, 15 Jan. - 15 Aug. 1979

James M. Whitney and Marvin Knight Dec. 1980 45 p refs (AF Proj. 2419)
(AD-A097033; AFWAL-TR-80-4104) Avail: NTIS HC A03/MF A01 CSCL 11/4

Tensile data on unidirectional composites generated from a flexural test usually yield a higher strength than observed from a standard tensile coupon. According to a statistical strength theory based on a Weibull distribution, the presence of a stress gradient in the flexure test results in an apparent increase in tensile strength as compared to the tensile test under uniform stress. In the present paper this concept is explored by utilizing data from undirectional graphite-epoxy composite to compare with theoretical results generated from a two parameter Weibull distribution. A larger variation in tensile strength is observed from tensile coupon data than from flexure data. Such differences are not in accordance with strength theories based on a uniform flaw distribution and raise questions concerning variability of the test methods, as well as sources of material variability. GRA

N81-22102# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.

RELATION OF STRUCTURE TO PROPERTIES IN GRAPHITE FIBERS Final Report, 30 Sep. 1977 - 30 Sep. 1980

R. J. Diefendorf, K. J. Chen, W. P. Seagroves, and J. J-H. Wang 31 Jan. 1981 49 p refs

(Grant AF-AFOSR-3436-77; AF Proj. 2303)

(AD-A096473; RPI-5-24015; AFOSR-81-0248TR) Avail: NTIS HC A03/MF A01 CSCL 11/5

The axial properties of carbon fibers were found to correlate well with preferred orientations determined by either X-ray diffraction or optical techniques. High modulus carbon fibers were found to have significant gradients in preferred orientation. For HMS fiber, the modulus of the surface layers is about twice the average fibers modulus, while the interior modulus is only about one-half the average. This modulus gradient suggests that higher modulus fibers, with good strength, could be produced, if the modulus at the interior of these fibers could be increased. The gradient in preferred orientation produces high residual stresses in HMS fibers. While the high surface compressive stresses minimize the effect of surface flaws, the high axial tensile stresses in the interior may decrease strength by causing fracture to initiate at flaws in the interior rather than at the surface. Similarly, the high axial compressive stressed outer layers of a fiber may initiate buckling when the fiber is compressively loaded. Modifications of the residual stress pattern might allow increased tensile and/or compressive strengths to be obtained in high modulus carbon fibers. Many correlations between properties and fiber diameter, reported in the past, may be in error because it is very difficult to determine the fiber diameter precisely and accurately. GRA

N81-22103# Naval Research Lab., Washington, D. C. Marine Technology Div.

ULTRASONIC INSPECTION OF A GRAPHITE/EPOXY STRUCTURAL MEMBER USING A THICKNESS-IMAGING DEVICE Interim Report

Henry H. Chaskelis 20 Mar. 1981 22 p refs

(SF61541501)

(AD-A096609; NRL-MR-4473) Avail: NTIS HC A02/MF A01 CSCL 11/4

Structural members, serving as models of a foil support strut for hydrofoil craft, have been built using graphite/epoxy material. A nondestructive evaluation (NDE) test is required to measure delamination (ply separation) as well as delamination growth which may occur during the structural fatigue testing cycle. This report describes the results of the first test sequence, using a ultrasonic thickness imaging instrument to accomplish the required NDE. These results support the contention that the ultrasonic thickness imaging device may be used to measure delamination growth in graphite/epoxy composites. GRA

N81-22104# Texas Univ. at Arlington. Dept. of Mechanical Engineering/Materials Science and Engineering.

INTERFACE CHARACTER OF ALUMINUM-GRAPHITE METAL MATRIX COMPOSITES Annual Technical Report, 1 Dec. 1979 - 30 Nov. 1980

Harris L. Marcus 23 Dec. 1980 89 p refs

(Contract N00014-78-C-0094)

(AD-A096626) Avail: NTIS HC A05/MF A01 CSCL 11/4

The results of the research described in this annual report can be summarized in terms of the experimental approaches used. The TEM studies of the phases in the aluminum-graphite interface demonstrated their complex nature. The method of preparing the thin foils, either chemical etching or chemical polishing, influenced which of the phases were observed. The interface phases observed were oxides, carbides and borides. In the studies of the aluminum deposited on single crystal of graphite the interface oxide formed is a simple aluminum oxide. The thickness of the aluminum oxide layer in the interface of aluminum-graphite junction system appeared to control the switching phenomenon observed in I-V measurements. Two different stable conducting states are present in the memory switching effects after the functions were properly electroformed. These states were dependent on the oxide thickness at the interface. SAM analysis of the fractured junction areas indicate the interface seems to be more cohesive resulting in fracture within the graphite when the thinner oxide layer is present. However, when the thickness of oxide is beyond certain limits (10nm), the fracture occurs in the oxide/graphite interface region. GRA

N81-22105# Texas Univ. at Arlington.

THE INTERFACE STRUCTURE IN GRAPHITE/ALUMINUM COMPOSITES

Swe-Den Tsai, Michael Schmerling, and Harris L. Marcus 1980 22 p refs

(Contract N00014-78-C-0094)

(AD-A096627) Avail: NTIS HC A02/MF A01 CSCL 11/4

Transmission electron diffraction and Auger electron spectroscopy studies of the interfaces of selected graphite/aluminum composite systems revealed that generally titanium diboride, (TiB2), and aluminum oxide, (Gammer Al2O3), were present as the interfacial phases. The grain size and the crystallographic structure of these interfacial phases were studied and are discussed in terms of the transverse fracture behavior of the graphite/aluminum composites. GRA

N81-22106# Boeing Co., Seattle, Wash. Boeing Military Airplane Development Dept.

ADVANCED FIBER REINFORCED THERMOPLASTIC STRUCTURES Final Report, 1 Aug. 1976 - 1 Aug. 1979

J. T. Hoggatt, S. Oken, and E. E. House Apr. 1980 289 p

(Contract F33615-76-C-3048; AF Proj. 2401)

(AD-A096759; AFWAL-TR-80-3023) Avail: NTIS HC A13/MF A01 CSCL 11/4

The objective of the program was to demonstrate the performance and cost savings of graphite/polysulfone. This objective was attained through a thirteen task program which cultimated in the design, fabrication and test of a full scale elevator torque box. The P-1700 polysulfone resin was selected and used with A-S unidirectional graphite fibers (Hercules 3004/A-S/P1700 prepreg) and with T-300 woven graphite fibers (Hexcel T-3004/23x24, 811 Satin Prepreg). Tooling concepts, consolidation and post forming processes, and field repair procedures were developed. The graphite/thermoplastic elevator had a 27% weight savings as compared to the aluminum elevator, and a cost saving of 20%, by the tenth elevator shipset. A limited study of a Union Carbide proprietary thermoplastic, known as PKXA, which has much improved solvent resistance as compared to P-1700 polysulfone, was conducted. This limited study showed that PKXA appeared to be a viable substitute for P-1700 polysulfone. It is recommended that a further study of PKXA be made in order to further optimize the manufacturing procedures for it. GRA

N81-22107# Iowa Univ., Oakdale. Dept. of Preventative Medicine and Environmental Health.

PROBLEMS ASSOCIATED WITH THE USE OF UREA-FORMALDEHYDE FOAM FOR RESIDENTIAL INSULATION. PART 3: RESIDENTIAL STUDIES IN COLORADO AND WISCONSIN

W. C. Schutte, R. S. Cole, C. W. Frank, and K. R. Long Feb. 1981 36 p refs

(Contract W-7405-eng-26)

(ORNL/SUB-7559-3) Avail: NTIS HC A03/MF A01

Formaldehyde levels were measured in homes in problem and nonproblem areas in Wisconsin and Colorado to elucidate the severity and the extent of formaldehyde emission under field conditions, help correlate laboratory findings with field observations, and investigate the cause and effect relationship between insulation stability and weather conditions of an area. Methods for selecting homes and sampling are described. Interviews were conducted with occupants of the homes and the data are tabulated. Results are summarized. Investigation forms are shown and weather information in Denver and Wisconsin is tabulated. DOE

N81-22108# Iowa Univ., Oakdale. Dept. of Preventive Medicine and Environmental Health.

PROBLEMS ASSOCIATED WITH THE USE OF UREA-FORMALDEHYDE FOAM FOR RESIDENTIAL INSULATION. PART 4: RELEVANCE OF MATERIALS STANDARDS TO PROBLEMS ASSOCIATED WITH THE USE OF UREA-FORMALDEHYDE FOAM INSULATION

Keith R. Long and William C. Schutte Feb. 1981 19 p refs

(Contract W-7405-eng-26)
(ORNL/SUB-7559-4) Avail: NTIS HC A02/MF A01

The insulation industry is essentially self regulated; therefore, the question arises as to whether or not increased public regulation would be effective in controlling problems associated with the use of urea-formaldehyde foam as residential insulation. The relevancy of public regulation to controlling problems such as off-gassing of formaldehyde associated with the use of the products through the introduction of materials standards and quality assurance of manufacture and installation is discussed. The use of urea-formaldehyde insulation may be divided into three phases manufacture, installation, and behavioral phases. The relevance of materials standards and quality assurance for each phase is discussed. DOE

N81-22109# General Electric Co., Schenectady, N. Y. Metallurgy Lab.
DEVELOPMENT OF A LOW LOSS MAGNETIC COMPOSITE UTILIZING AMORPHOUS METAL FLAKE Semiannual Report, 19 Sep. 1979 - 18 Mar. 1980
Lyman Johnson Apr. 1980 40 p refs
(Contract ET-78-C-01-3205)
(CONS-3205-T3; SAPR-3) Avail: NTIS HC A03/MF A01

The feasibility of casting amorphous metal ribbon in the shape of a helix with properties suitable for motor applications was determined. The tasks included: (1) determination of the casting parameters required to produce a helical ribbon; (2) evaluation of magnetic properties and methods for bonding; and (3) developing methods for patterning a wheel for producing motor slots in as cast ribbon. DOE

N81-22110# Los Alamos Scientific Lab., N. Mex.
FIBER FELTS AS LOW-DENSITY STRUCTURAL MATERIALS
John V. Milewski and Stephen E. Newfield Jan. 1981 11 p ref
(LA-8570) Avail: NTIS HC A02/MF A01

It is noted that short fiber felt structures provide improvements in properties over foam structures. In application where resistance to compression set or stress relaxation are important, coated fiber felts excel because the individual fibers flex within their elastic limits. Felts of stainless steel and polyester fibers were prepared by deposition from liquid slurries. Compressive properties were determined as functions of the felt parent material, the extent of bonding, the density of the felt, and the length to diameter ratio of the starting fibers. M.G.

N81-22111# Oak Ridge National Lab., Tenn. Dept. of Preventive Medicine and Environmental Health.
PROBLEMS ASSOCIATED WITH THE USE OF UREA-FORMALDEHYDE FOAM FOR RESIDENTIAL INSULATION. PART 2: THE EFFECTS OF TEMPERATURE AND HUMIDITY ON FREE FORMALDEHYDE, EXTRACTABLE FORMALDEHYDE, FORMALDEHYDE EMISSION, AND PHYSICAL CHARACTERISTICS OF THE FOAM
W. C. Schutte, R. S. Cole, C. W. Frank, and K. R. Long Feb. 1981 89 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-7559/2-Pt-2) Avail: NTIS HC A05/MF A01

Results of testing with two products of urea formaldehyde based foams are discussed. Methods for detection and quantitative determination of formaldehyde, design of the experimental chambers, and the procedures are described. Samples of product D were monitored for about 29 days and samples of product E were monitored for 60 days in chambers and results are tabulated for formaldehyde emission. Additional tests performed on the two products were: extractable formaldehyde (high and low temperature conditions); free formaldehyde (high and low temperature conditions); comparison of free formaldehyde concentration; density (high and low temperature conditions); and shrinkage (high and low temperature conditions). Control panels were constructed to simulate a wall in a home and observations were made and compared with results of the experimental products. DOE

N81-22112# Strack (Hermann C.) Berlin, Goslar (West Germany). Forschungsabteilung.
DEVELOPMENT AND PRODUCTION OF SILICON NITRIDE POWDER FOR MAXIMUM DENSIFICATION Final Report
Wolfgang Glaeser and Bruno Krismer Paris Bundesministerium fuer Forschung und Technologie Dec. 1979 16 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-154; ISSN-0340-7608) Avail: NTIS HC A02/MF A01

An isostatic method for densification to near theoretical limits is proposed. This method requires high purity SiN powder, predominantly in the alpha phase, and with a very large sinter active specific surface area. An economically feasible, semicontinuous process for the nitriding of silicon metal power was developed which meets the requirements of hot pressing densification. Author (ESA)

N81-22113# European Space Agency, Paris (France).
INFLUENCE OF PROCESSING CONDITIONS ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF REACTION SINTERED SILICON NITRIDE
Juergen Heinrich Dec. 1980 91 p refs Transl. into ENGLISH of "Der Einfluss von Herstellungsbedingungen auf das Gefuege u. die mechanischen Eigenschaften von Reaktionsgesintertem Siliciumnitrid", Rept. DFVLR-FB-79-32 DFVLR, Cologne, Sep. 1979 Original report in GERMAN previously announced as N80-24383
(ESA-TT-650; DFVLR-FB-79-32) Avail: NTIS HC A05/MF A01

The microstructure of reaction bonded silicon nitride (RBSN) was changed in a wide range by varying green density, grain size of the silicon starting powder, nitriding conditions, and by introducing artificial pores. The influence of individual microstructural parameters on mechanical properties such as room temperature strength, creep behavior, and resistance to thermal shock was investigated. The essential factors influencing these properties are total porosity, pore size distribution, and the fractions of alpha and beta Si3N4. In view of high temperature engineering applications of RBSN, possibilities of optimizing the material's properties by controlled processing are discussed. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N81-22114 Pennsylvania State Univ., University Park.
LASER SPECTROSCOPY OF BIOLOGICAL MACROMOLECULES. 1: DYNAMIC LIGHTS Ph.D Thesis
Elisabeth Jane Berger 1980 97 p
Avail: Univ. Microfilms Order No. 8107539

Two areas of laser spectroscopy, dynamic light scattering and optoacoustic spectroscopy, were investigated. Dynamic light scattering was used to investigate the pH induced alpha helix random coil transition in poly-L-glutamic acid. By measuring the translational diffusion coefficient the transition was monitored as a function of pH. A theoretical investigation was made of the possibility of using DLS to determine the kinetics of the transition. It was determined that this is not possible. Optoacoustic spectroscopy was used as an analytical technique to detect human hemoglobin in aqueous solution in nonomolar concentrations. A pulsed laser system was used to excite the solute and a piezoelectric transducer was used to detect the acoustic waves. Dissert. Abstr.

N81-22115 Utah Univ., Salt Lake City.
DEVELOPMENTS AND APPLICATIONS OF SOME QUANTUM CHEMICAL METHODS Ph.D. Thesis
Ronnie Lee Shepard 1980 146 p
Avail: Univ. Microfilms Order No. 8106870

The electronic structure is determined for the metal dimers Li2, LiNa, and Na2 and their anions at the self consistent held level of approximation. The ground state anions of these dimers

were found to be stable with vertical electron affinities of 0.32, 0.35, and 0.30 eV respectively. The respective adiabatic electron affinities were determined to be 0.46, 0.45 and 0.42 eV. It is estimated from comparison with other calculations that electron correlation would increase these values by 0.05-0.20 eV. The Green's function formalism in the superoperator notation was extended to admit a multiconfiguration reference state. The advantages of this more general reference state over the Hartree-Fock state are discussed. Hermiticity of the superoperators for the multiconfiguration reference state is analyzed. Explicit formulas and calculation procedures for the implementation of this Green's function theory are given and specialized to include terms consistent through second order. Dissert. Abstr.

N81-22116 Wayne State Univ., Detroit, Mich.
THEORETICAL STUDIES OF THE FORMATION AND DECOMPOSITION OF VIBRATIONALLY EXCITED MODEL ALKYL RADICALS Ph.D. Thesis
Ralph Joseph Wolf 1980 405 p
Avail: Univ. Microfilms Order No. 8107252

The Monte Carlo classical trajectory method is used to investigate the dynamics of C-H bond rupture in H-C-C. Eleven different potential energy surfaces were studied to understand the effects of specific surface properties on unimolecular lifetime and product distributions. The model reaction H-C-C yields H + C = C is a prototype alkyl radical decomposition. Excitation of the H-C-C species is provided by random sampling of the molecular phase space at a constant energy (as assumed by the RRKM theory of unimolecular reactions). One of the potential energy surfaces, which closely resembles a true alkyl radical decomposition, is investigated in detail by random sampling and by molecular beam sampling. In the beam sampling the H atom is added to the C C diatom to form a vibrationally excited H-C-C intermediate which decomposes back to reagents. Dissert. Abstr.

N81-22117 Pennsylvania State Univ., University Park.
SYNTHESES, SPECTRAL STUDIES, AND STRUCTURE DETERMINATIONS OF MODEL SYSTEMS FOR COBALT-SUBSTITUTED ZINC METALLOPROTEINASES Ph.D. Thesis
Joseph Nickolas Ishley 1980 210 p
Avail: Univ. Microfilms Order No. 8107583

A series of complexes were synthesized to use as models for the active sites of metalloproteinases. The crystal structures of four cobalt complexes and two zinc complexes were determined. All of the complexes exist as distorted tetrahedra except for one which is a severely distorted octahedron. There are only a few minor changes seen between analogous complexes of cobalt and zinc, confirming that cobalt substitution of zinc for use as a spectroscopic probe is a valid technique. Dissert. Abstr.

N81-22118 Texas A&M Univ., Galveston.
THE ION-EXCHANGE AND CATALYTIC PROPERTIES OF TITANIUM PHOSPHATES AND MIXED TITANIUM-ZIRCONIUM PHOSPHATES Ph.D. Thesis
Teresita Naila DeLa Cueva Frianeza 1980 240 p
Avail: Univ. Microfilms Order No. 8108008

Solutions of the compounds were prepared and their properties correlated with reference to the pure analogues. These crystalline titanium zirconium phosphates of composition 20, 33, and 80 mole percent titanium were characterized from two standpoints, namely: (1) ion exchange behavior and (2) catalytic properties. Their behavior towards Na(+)-H(+) exchange was determined and interpreted on the basis of the known behavior of the pure phases. It was found that those high in zirconium behave as zirconium phosphates and exhibit relatively low hydrolysis of phosphate groups while those high in titanium behave like titanium phosphate in many respects. This analogy was also observed in their catalytic properties, i.e., surface area, acidity, and activity in the dehydration of cyclohexanol. The dehydration reaction was found to be first order in alcohol concentration and to increase in rate with increase of pretreatment temperature. Dissert. Abstr.

N81-22119 Northeastern Univ., Boston, Mass.
AN INVESTIGATION OF THE MAGNETIC PROPERTIES OF SOME POLYMERIC FIRST ROW TRANSITION METAL ION COMPLEXES Ph.D. Thesis
Glenn Alan Eisman 1980 162 p
Avail: Univ. Microfilms Order No. 8106993

The magnetic properties of the series M(di-imine)X2(M = Mn, Fe, Co, and Ni, di-imine = 2,2'-bipyridine or 1,10-phenanthroline, X = halide or pseudo-halide) were studied by vibrating sample magnetometry. The results of the magnetic susceptibility and isothermal magnetization data taken in the temperature range 1.6 to 100 K are indicative of three dimensionally ordered ferromagnets. Furthermore, the compounds are similar in that they exhibit critical temperatures below 10 K. Ferromagnetic interactions are postulated from the sharp rise in the isothermal magnetization data together with the applied magnetic field dependence of the molar susceptibility. Dissert. Abstr.

N81-22120 Cincinnati Univ., Ohio.
THIN-LAYER ELECTROCHEMICAL TECHNIQUES FOR MEASURING FORMAL REDOX POTENTIALS OF BIOLOGICAL SYSTEMS. PART 1: TEMPERATURE DEPENDENCE OF REDUCTION POTENTIAL OF CYTOCHROME C, PART 2 Ph.D. Thesis
Chih-Ho Su 1980 184 p
Avail: Univ. Microfilms Order No. 8107507

The measurement of the formal electrode potential and the electron stoichiometry of a redox couple by thin layer potential step coulometry (TLPSC) and thin layer potential pulse coulometry (TLPPC) was demonstrated with ferricyanide, toluidine blue, 2,6-dichlorophenolindophenol, and the biological redox component cytochrome c. A computer program based on the Nernst equation was used to predict the charge potential curves in the TLPSC and TLPPC techniques. The significant advantages of thin layer method are good precision of measurement, the inherent simplicity of the technique, and the capability of performing measurements on less than a milliliter of solution. The most important advantage of the TLPSC and TLPPC techniques is that the electrode potential value of an electroinactive biological redox couple which has no optical property upon which a spectroelectrochemical experiment can be based can be determined. Dissert. Abstr.

N81-22121 Cincinnati Univ., Ohio.
DETERMINATION OF THE SUITABILITY OF PHOTON-INDUCED X-RAY FLUORESCENCE ANALYSIS FOR THE QUANTITATION OF SELECTED LOW-ATOMIC-NUMBER TRACE ELEMENTS IN BIOLOGICAL MATERIALS Ph.D. Thesis
Paul Alan Feller 1980 231 p
Avail: Univ. Microfilms Order No. 8107485

One part of the investigation consisted of Monte Carlo modeling of two systems, one employing an Fe(55) radionuclide excitation source and the other using a 55-kVp X-ray tube and an iron secondary fluorescer excitation system. The ability of each simulation to predict relative responses for each element was assured by experimentally analyzing a series of starch pellets doped with low concentrations of the three elements. The experimental data yielded values for each element of minimum detectable concentrations for the experimental configurations. Geometrical and source constants were adjusted in the Monte Carlo simulations and the improvements in minimum detectable concentrations for the optimized configurations were predicted. Dissert. Abstr.

N81-22122 Oklahoma Univ., Norman.
THE SYNTHESIS AND CHARACTERIZATION OF CHLORINATED POLYETHYLENE-g-STYRENE AND ITS APPLICATION AS A BLEND MODIFIER Ph.D. Thesis
Teng-Shau Young 1980 196 p
Avail: Univ. Microfilms Order No. 8107970

Chlorinated polyethylene-g-styrene copolymers were synthesized by chemical and radiation initiation methods. With the use of a preinitiation technique, graft efficiency as high as 0.84 was achieved from the chemical initiated graft copolymerization. The chemical initiated grafting was found to be significantly affected by the degree of swelling, initiation time, and temperature and concentration of initiator and monomer. High initiation temperatures or long initiation times may result in crosslinking in the CPE films. The radiation induced grafting was carried out using a mutual irradiation method and graft efficiency was found to

be around 0.40. No crosslinking was observed with the dose level used in this study. Dissert. Abstr.

N81-22123 Pennsylvania State Univ., University Park.
A KINETIC AND INFRARED STUDY OF CARBON MONOXIDE ADSORPTION AND HYDROGENATION ON PALLADIUM CATALYSTS Ph.D. Thesis
Shi-Yann Wang 1980 216 p
Avail: Univ. Microfilms Order No. 8107648

The synthesis of hydrocarbons from CO and H2 provides one route to convert heavy, hydrogen deficient materials into clean fuels and chemicals. The effects of metal support interactions and crystallite size on the state of CO adsorption and on the catalytic behavior of Pd catalysts were determined. The possibility that certain forms of adsorbed CO were more reactive was also to be examined. A Langmuir-Hinshelwood kinetic model for the methanation reaction on these Pd catalysts was proposed which satisfactorily describes the kinetic data and is consistent with the interpretation of the IR spectra. The hydrogen assisted rupture of the C-O bond was proposed as the rate determining step in the methanation reaction. Results obtained from a transition state theory analysis also indicated that the density of active sites is much lower than that of surface Pd atoms. Dissert. Abstr.

N81-22124 Pennsylvania State Univ., University Park.
STUDIES IN PHOSPHATE BONDING Ph.D. Thesis
Francisco Javier Gonzalez-Aleu 1980 265 p
Avail: Univ. Microfilms Order No. 8107572

The effect of particle reactivity on bonding phase development in Al2O3 -H3PO4 compositions was studied. Reactivity of the materials, as measured by specific surface area, crystallinity, and overall bulk concentration, plays an important role in determining the amounts of the different phases formed by the reaction of H3PO4 with Al2O3. The total amount of surface area of the Al2O3 power per mole of P2O5 in the reacting system, termed the relative activity, is directly proportional to the quantity of alumina reacted. The relative yields of aluminum phosphates are also dependent on the relative activity of the system. Low relative activity compositions yielded phosphates in which the Al/P atomic ratio is low, such as Al(H2PO4)3 (C-type), AlH2P3O10-2H2O, or Al(PO3)3 (B-type). As the relative activity increased, these phosphates were gradually replaced by products in which the Al/P ratio is high as in the polymorphs of AlPO4. Laboratory made 95 percent alumina refractories in which three different calcined aluminas were used as binders in combination with H3PO4, showed that excess relative activity is detrimental in terms of mechanical properties at elevated temperatures.
Dissert. Abstr.

N81-22125 Georgia Univ., Athens.
OPTIMIZATIONS OF COMPLEX SEPARATIONS Ph.D. Thesis
William Armstrong Spencer 1980 294 p
Avail: Univ. Microfilms Order No. 8107949

Three topics in separation are presented: the use of information theory to provide a criterion for comparison of separations; the simultaneous gas chromatography of three boiling range fractions of a single sample; and the separation of vanadium compounds from Boscan crude oil. The amount of information conveyed by a chromatogram has been determined as a sum from each datum in a digital record. The information was calculated from the disagreement of a datum value with its predicted value. Predictions for each datum were based on its relationship to a threshold, on previous data, and on Gaussian behavior. The resulting separation number (SN) was calculated for both simulated and real data so as to determine the effect of different variables including sampling rate and noise level. For the first time, partial fractionation of a vanadium nonporphyrin fraction was reported. Dissert. Abstr.

N81-22126 California Univ., Santa Barbara.
TEMPERATURE MEASUREMENTS IN FLAMES USING ROTATIONAL RAMAN SCATTERING Ph.D. Thesis
Bhagwant Singh Samyal 1980 206 p
Avail: Univ. Microfilms Order No. 8108074

The rotational intensities for temperature determination are measured by both analog and computer-controlled experiments. In the latter case, a computer is used to advance the spectrometer in the lines of interest and to retrieve data via a counter. Rotational temperatures, based on Raman scattering from N2, in premixed H2-air, H2/O2/N2 and H2-O2 flames are determined. In premixed CH4-air flames, temperatures are determined from the Raman scattering of both N2 and O2. The measurements are precise to within 3 percent. Radial and axial profiles of rational temperature are presented. Corrections for rational-vibrational interactions and for the effects of rotational transitions from vibrationally excited molecules are included in the temperature calculations. Rotational Raman scattering is potentially useful for nonperturbing, point measurements of temperature and concentration in flames at atmospheric pressure. Dissert. Abstr.

N81-22127 Princeton Univ., N. J.
RAMAN SPECTROSCOPY AND VIBRATIONAL ANALYSIS OF OXIDATION-REDUCTION COENZYMES Ph.D. Thesis
Worth David Bowman 1981 246 p
Avail: Univ. Microfilms Order No. 8106913

Raman spectroscopy and vibrational analysis were used to probe structural features and nucleotide protein interactions of two oxidation-reduction coenzymes, flavin and nicotinamide. The biological function of redox coenzymes and data on specific enzyme coenzyme interactions are reviewed. The theoretical basis for molecular orbital constraint of interaction coordinates (MOCIC) is covered in some detail. The MOCIC technique was used to provide potential energy functions for two components of the flavin isoalloxazine ring, uracil and pyrazine. Dissert. Abstr.

N81-22128 Oregon State Univ., Corvallis.
PHOTOELECTRON SPECTROSCOPY OF SMALL MOLECULES Ph.D. Thesis
Kenneth David Bomben 1981 154 p
Avail: Univ. Microfilms Order No. 8108199

The photoelectron spectra of a series of halogenated molecules were investigated in the gas phase. Both core-ionization energies and Auger kinetic energies were measured to probe the nature of the interaction that holds a core electron to the molecule. It was found that satellite structure (shake) could be used to predict the amplitude attenuation in the Br2 EXAFS spectrum. Inclusion of multielectron processes into the theory that predicts the EXAFS amplitude provides a more accurate representation of the EXAFS spectrum if certain assumptions about the threshold of shake are valid. The satellites can be used to investigate the nature of the transitions themselves. In the case of argon, the transitions arise from Rydberg processes that excite a 3p valence electron to the 4p or 5p. In addition, the shake structure allows a measurement of the relaxation energy. Investigation of the extra-atomic relaxation energy by means of the Auger parameter was found to yield information on the nature of electronegativity. Dissert. Abstr.

N81-22129*# Boeing Co., Seattle, Wash.
SERVICE EVALUATION OF ALUMINUM-BRAZED TITANIUM (ABTI)
S. D. Elrod Washington NASA May 1981 43 p refs
(Contract NAS1-13681)
(NASA-CR-3418; D6-48609) Avail: NTIS HC A03/MF A01 CSCL 11F

Long term creep-rupture, flight service and jet engine exhaust tests on aluminum-brazed titanium (ABTi), originally initiated under the DOT/SST follow-on program, were completed. These tests included exposure to natural airline service environments for up to 6 years. The results showed that ABTi has adequate corrosion resistance for long time commercial airplane structural applications. Special precautions are required for those sandwich structures designed for sound attenuation that utilize perforated skins. ABTi was also shown to have usable creep-rupture strength and to be metallurgically stable at temperatures up to 425 C (800 F). A.R.H.

N81-22130*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
INVESTIGATION OF AIR SOLUBILITY IN JET A FUEL AT HIGH PRESSURES Final Report
S. D. Rupprecht and G. M. Faeth Washington NASA May 1981 111 p refs
(Grant NsG-3308)
(NASA-CR-3422) Avail: NTIS HC A06/MF A01 CSCL 07D

The solubility and density properties of saturated mixtures of fuels and gases were measured. The fuels consisted of Jet A and dodecane, the gases were air and nitrogen. The test range included pressures of 1.03 to 10.34 MPa and temperatures of 298 to 373 K. The results were correlated successfully, using the Soave equation of state. Over this test range, dissolved gas concentrations were roughly proportional to pressure and increased slightly with increasing temperature. Mixture density was relatively independent of dissolved gas concentration. Author

N81-22131# Westinghouse Research and Development Center, Pittsburgh, Pa.
PROGRAM TO INVESTIGATE LASER INDUCED SYNTHESIS OF CHEMICAL MATERIALS Final Technical Report, 1 Jul. 1978 - 30 Jun. 1980
P. M. Castle Nov. 1980 48 p refs
(Contract F49620-78-C-0113; AF Proj. 2303)
(AD-A096946; AFOSR-81-0242TR) Avail: NTIS HC A03/MF A01 CSCL 07/5

This final technical report describes the work specifically directed toward the use of lasers to synthesize highly reactive fluorine containing species as well as related work carried out under Westinghouse support related to the general use of lasers for chemistry. The original objectives concerning the synthesis of NF4BF4 and related compounds were not achieved. It is not felt, however, that this lack of success lies as much in the lack of validity in the techniques but, rather, inexperience in the area of fluorine chemistry. GRA

N81-22132# Science Applications, Inc., McLean, Va.
COMBUSTION HYDRODYNAMICS AND CHEMISTRY Final Report, 4 Jan. 1980 - 4 Jan. 1981
Ellis Hyman Feb. 1981 85 p refs
(Contract N00173-80-C-0101)
(AD-A096504; SAI-82-350-WA; NRL-MR-4466) Avail: NTIS HC A05/MF A01 CSCL 21/2

Accomplishments in combustion hydrodynamics and chemistry studies consisted of a computational study of the chemical kinetics of hydrogen combustion along with some subsidiary studies and programming. Comparisons with experimental results have been generally good over a broad range of reaction conditions for induction times, seconds explosion limits, and other parameters. GRA

N81-22133# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
AN INVESTIGATION OF SLURRY FUEL COMBUSTION Final Report, Nov. 1979 - Oct. 1980
G. A Szekely and G. M. Faeth Jan. 1981 54 p refs
(Contract F33615-77-C-2004)
(AD-A096765; AFWAL-TR-80-2125) Avail: NTIS HC A03/MF A01 CSCL 21/2

A theoretical and experimental investigation of the combustion properties of carbon slurry fuels was performed. This involved observing the combustion of individual drops (400-1000 micrometer in diameter) supported at various positions within an open, turbulent diffusion flame. When a slurry drop was exposed to the flame, the liquid fuel in the slurry evaporated in the first stage, leaving a carbon agglomerate consisting of all the carbon particles originally in the slurry. The second stage of the process involved heat-up reaction of the agglomerate consumption of the agglomerate was the lowest step in the process, requiring 90-95 percent of the lifetime of the particle, even in regions where agglomerate reaction was fast. An analysis was developed to provide predictions of agglomerate reaction rates and lifetimes. The model was tested with measurements in the lean portions of the flame (equivalence ratios in the range 0.272-0.778). GRA

N81-22134# American Univ., Washington, D. C. Dept. of Chemistry.
INFRARED SPECTRA OF ALUMINUM SALT SOLUTIONS Technical Progress Report, 1 Jan. - 1 Dec. 1980
J. F. McIntyre, R. T. Foley, and B. F. Brown Jan. 1981 30 p refs
(Grant DAAG29-78-G-0165)
(AD-A096766; TR-11; ARO-15539.3-MS) Avail: NTIS HC A03/MF A01 CSCL 07/4

Aluminum salt solutions activate metallic aluminum surfaces at different rates. The objective of this investigation was to attempt to establish whether or not structural differences at the molecular level could account for the chemical reactivity. The infrared spectra of various concentrations of aluminum chloride, aluminum nitrate, aluminum perchlorate, and aluminum sulfate were measured. The spectra included several general features: (1) a broadening of the OH stretching band of water, (2) a splitting of the OH stretch of water into several absorption bands, (3) the emergence of a new absorption band at 2400 cm-1 (related to dimer formation), (4) occasional splitting of the OH bending mode of water, and (5) no direct evidence of anion-cation covalent bonding. In general, there was no differences at the molecular level between these aluminum salt solutions that would account for differences in chemical reactivity. GRA

N81-22135# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DOPPLER-LIMITED SPECTRUM OF HIGH TEMPERATURE WATER VAPOR IN THE 3000 TO 4000 cm (-1) REGION Final Report, 1 Oct. 1979 - 30 Sep. 1980
Alan S. Pine 11 Feb. 1981 85 p refs
(Contract F19628-80-C-0002; AF Proj. 2300)
(AD-A096718; ESD-TR-80-243) Avail: NTIS HC A05/MF A01 CSCL 07/4

The absorption spectrum of water vapor has been recorded at very high temperatures (approximately 1200 K) in the 3000 to 4000 1/cm region with Doppler-limited resolution using a tunable difference-frequency laser spectrometer. This region encompasses the strong OH stretching fundamentals and the bending overtone. The higher rotational and vibrational energy levels observed here are expected to lead to extended theoretical models of H20 which are necessary to predict and analyze spectra from high temperature combustion processes. GRA

N81-22136# Kent State Univ., Ohio.
ADSORPTION AND DESORPTION OF HYDROCARBONS AT LOW CONCENTRATIONS Progress Report
Richard Madey and Jan-Chan Huang Jan. 1981 26 p refs
(Contract DE-AC02-80ER-10622)
(DOE/ER-10622/1) Avail: NTIS HC A03/MF A01

Investigation of both the physical chemical characteristics of isothermal adsorption on activated carbon and the dynamics of isothermal transfer of low concentration hydrocarbons through adsorber beds were conducted. Research accomplishments during the report period include the following: study of the transport of methane in helium at concentrations from 34 to 100 ppM through an activated carbon adsorber bed; generation of adsorption data for methane, acetylene, and ethane at 250 C for concentrations from 50 ppM to 10,000 ppM; generation of adsorption capacities at 250 C and correlation of the adsorption isotherm for propane at 250 C; study of the transmission of adsorption capacities of ethane and acetylene at 100 C; measurement of the transmission of positive pulses by methane and acetylene for concentrations below 100 ppM; and adsorption of binary mixtures. E.D.K.

N81-22137# Hungarian Academy of Sciences, Budapest. Inst. of Isotopes.
USE OF ELECTRON CAPTURE GAS CHROMATOGRAPHY FOR THE ANALYSIS OF AROMATIC HYDROCARBONS. PART OF A COORDINATED PROGRAMME ON THE USE OF ELECTRON CAPTURE GAS CHROMATOGRAPHY IN ORGANIC ANALYSIS Final Report, 1 Apr. 1977 - 30 Jun. 1980
L. Wojanrovits Jun. 1980 53 p refs Sponsored by IAEA
(IAEA-R-1969-F) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

In a systematic study for the detection of aromatic hydrocarbons with electron capture detector it was found that benzene and monoalkyl benzenes give weak signals; penta-, hexamethylbenezenes, biphenyl, and naphthalenes exhibit medium responses; and polynuclear aromatics, diphenylethylenes, diphenylacetylene, and azulene show high signals of response. The temperature dependence of the equilibrium constant of electron absorption and desorption reactions can be used to determine the electron affinities of compounds exhibiting medium or high responses. The EA values for 39 aromatic hydrocarbons were found in the order of 0.07 to 0.6 eV. It was also found that the rates of electron absorption increases with increased

electron affinity of the molecules, whilst the rates for desorption of electron decrease for molecules with stronger electron affinity. DOE

N81-22138# Illinois Univ. at Chicago Circle, Chicago.
LASER SCHLIEREN, SHOCK TUBE STUDIES OF HIGH TEMPERATURE HYDROCARBON PYROLYSIS RATES Progress Report, 1 Jun. 1980 - 31 Jan. 1981
J. H. Kiefer Jan. 1981 19 p refs
(Contract DE-AS02-78ER-04759)
(DOE/ER-04759/3) Avail: NTIS HC A02/MF A01

Progress during the period was in five areas: completion of a rigorous physical optics study of laser-schlieren measurements, completion of a study showing that angled laser beam refraction by the shock front can give accurate values for total density change, continuation of a study of the induction time for CO2 dissociation, improvements in equipment, and near completion of an extensive study of propane pyrolysis. The propane pyrolysis study has provided rates for the primary step C3H8 yields CH3 + C2H5 over the range 1400 to 24000K. DOE

N81-22139# Florida State Univ., Tallahassee. Dept. of Chemistry.
RESEARCH IN ACTINIDE CHEMISTRY Progress Report, 1 Mar. 1980 - 28 Feb. 1981
Gregory R. Choppin 1981 18 p refs
(Contract EY-76-S-05-1797)
(DOE/ER-01792/96) Avail: NTIS HC A02/MF A01

The interaction of trivalent actinides with a wide variety of both inorganic and organic ligands was investigated with emphasis on the thermodynamics and kinetics of complexation at tracer concentrations using radio-chemical techniques. In order to expand the scope of the experimental techniques, thereby obtaining additional understanding of the fundamental processes involved, nonradioactive experiments with the trivalent lanthanides were conducted. Visible spectroscopy, nmr spectroscopy, potentiometry, solvent extraction, and calorimetry are examples of techniques for these lanthanide studies which have allowed much more thorough interpretation of the actinide tracer data due to the close chemical similarity of the lathanide and actinide families of trivalent cations. DOE

N81-22140# Department of Energy, Washington, D. C. Div. of Chemical Sciences.
CARBON-13 MAGNETIC RESONANCE OF HYDROCARBONS Progress Report, 1 Sep. 1978 - 28 Feb. 1981
D. K. Dalling and Fred Morin 1981 12 p refs Prepared in cooperation with Utah Univ., Salt Lake City
(Contract DE-AC02-78ER-05006)
(DOE/ER-05006/2) Avail: NTIS HC A02/MF A01

Carbon 13 and proton nmr data were required for the following series of compounds: tetralin and sixteen of its methylated derivatives; eleven methylated tetrahydrophenanthrene which include the parent compound; and 9,10-dihydrophenanthrene and four of its 9,10 methylated isomers. Data for all these compounds are provided and a detailed discussion on their molecular structure from the chemical shift studies is presented. The temperature dependence of the solution chemical shifts of various methylated derivatives of tetralin was also determined in CDCL4 from 40 C to 65 C. DOE

N81-22141# Energy and Environmental Research Corp., Santa Ana, Calif.
SOOT FORMATION IN SYNTHETIC-FUEL DROPLETS Quarterly Technical Progress Report, Oct. - Dec. 1980
G. England, J. Kramlich, and R. Payne Jan. 1981 14 p refs
(Contract DE-AC22-80PC-30298)
(DOE/PC-30298/T1; QTPR-1) Avail: NTIS HC A02/MF A01

Detailed information is given on methods of minimizing soot formation during synthetic liquid fuel combustion under conditions which minimize fuel nitrogen conversion to nitric oxide. Fuel screening studies investigate the impact of fuel properties on particulate production, establish the importance of droplet size and examine atomizer effects, and develop techniques for surrogate fuels productions. Flame studies investigates soot formation from synfuel droplet combustion configurations in variable slip velocity configurations. DOE

N81-22142# Energy and Environmental Research Corp., Santa Ana, Calif.
ASSESSMENT OF PULVERIZED COAL-FIRED COMBUSTOR PERFORMANCE Quarterly Technical Progress Report
W. Richter, W. Clark, and R. Payne Jan. 1981 26 p refs
(Contract DE-AC22-80PC-30297)
(DOE/PC-30297/T1; QTPR-1) Avail: NTIS HC A03/MF A01

An assessment of the performance of industrial furnaces firing pulverized coal incorporates two experimental tasks and is constructed around an analytical task which identifies and upgrades the family of computer programs required to undertake the performance analysis studies. These analytical tools are used to predict the effect of parameters such as fuel type and furnace variables on combustor performance, and to identify those properties which have a major impact on thermal performance. The second task uses a combustion reactor to screen the key variables identified and to provide data on the properties of coal particulate matter which affect heat transfer performance. Verification of the engineering analytical approach is provided by measurements made in a pilot-scale furnace. DOE

N81-22143# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PULSE COMBUSTION TECHNOLOGY FOR HEATING APPLICATIONS Quarterly Progress Report, 1 Jul. - 30 Sep. 1980
C. A. Blomquist, J. M. Clinch, and H. P. Egbert Nov. 1980 23 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-117) Avail: NTIS HC A02/MF A01

A technology base for fossil fuel-fired pulse combustion heating systems is developed. Design data and design procedures for pulse combustion burners are proposed. Basic performance characteristics, including heat transfer rates, thermal efficiency, noise emissions, and exhaust gas composition, are obtained as a function of the primary combustion design parameters, including combustor geometry, fuel/air ratio, valve geometry, and decoupling chamber size. A mathematical model of the combustor is developed for use as an engineering design tool in establishing combustor geometry for specific applications and for defining trade-offs between system efficiency, noise emissions, and cost. Noise and pressure-fluctuation data are characterized and analyzed with respect to frequency and amplitude. Preliminary experimental and analytical investigations are initiated to develop a basis for extending the pulse combustion concept to liquid and solid fuel-burning systems. DOE

N81-22144# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PHOTOELECTROSYNTHESIS AT SEMICONDUCTOR ELECTRODES
A. J. Nozik Dec. 1980 33 p refs Presented at 3rd Intern. Conf. on Photochem. Conversion and Storage of Solar Energy, Golden, Colo.
(Contract DE-AC02-77CH-00178)
(SERI/TP-623-1045; CONF-800827-4) Avail: NTIS HC A03/MF A01

The general principles of photoelectrochemistry and photoelectrosynthesis are reviewed and some new developments in photoelectrosynthesis are discussed. Energetics of semiconductor-electrolyte interfaces (band-edge unpinning), hot carrier injection at illuminated semiconductor-electrolyte junctions, derivatized semiconductor electrodes, particulate photoelectrochemical systems, layered compounds and other new materials, and dye sensitization are discussed. DOE

N81-22145# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF ADVANCED TECHNOLOGIES FOR PHOTOCHEMICAL TRITIUM RECOVERY Biquarterly Program Report, 1 Apr. - 30 Sep. 1980
I. P. Herman and J. B. Marling 6 Nov. 1980 28 p refs
(Contract W-7405-eng-48)
(UCID-18509-80-2-3) Avail: NTIS HC A03/MF A01

The laboratory facility for photochemical tritium separation research was completed. Methods for synthesizing the monotritiated halogenated methanes were developed. Notably, CTF3 was synthesized and spectrally analyzed. The CTF3 vibrational

frequencies are found to be in good agreement with earlier calculations. DOE

N81-22146# University of Southern California, Los Angeles.
CHEMISTRY AND STRUCTURE OF COAL DERIVED ASPHALTENES AND PREASPHALTENES Quarterly Progress Report, Apr. - Jun. 1980
T. F. Yen 1980 97 p refs
(Contracts DE-AC01-76ET-10626; EX-76-C-01-2031)
(FE-2031-17) Avail: NTIS HC A05/MF A01

The asphaltene and preasphaltene fractions are isolated from coal liquids from a number of liquefaction processes. These processes consist of in general: catalytic hydrogeneration, staged pyrolysis, and solvent refining. The asphaltene fractions may be further separated by both gradient elution through column chromatography, and molecular size distributions through gel permeation chromatography. Those coal derived asphaltene and preasphaltene fractions are investigated by various chemical and physical methods for characterization of their structures. The parameters are correlated with the refining and conversion variables which control a given type of liquefaction process. The effects of asphaltene in catalysis, ash or metal removal, desulfurization and denitrification are also correlated. DOE

N81-22147# Risoe National Lab., Roskilde (Denmark). Dept. of Reactor Technology.
THERMAL AND MECHANICAL PROPERTIES OF NITROGEN
P. Ottosen and G. Mannov Jun. 1980 37 p refs
(RISO-M-2230) Avail: NTIS (US Sales Only)HC A03/MF A01; DOE Depository Libraries

Routines for the physical properties of nitrogen liquid and gas (1 to 6 bar) are presented. The approximations are polynomials worked out by the least squares method. The fitted expressions are compared with experimental data, and the accuracy is approximately one percent. DOE

N81-22148# Nebraska Univ., Lincoln. Dept. of Chemistry.
PRINCIPAL PROCESSES IN THE RADIOLYSIS OF GASES WITH FISSION RECOILS AND GAMMA RAYS Annual Progress Report, 16 Oct. 1979 - 15 Sep. 1980
G. G. Meisels Oct. 1980 23 p refs
(Contract DE-AS02-76ER-02567)
(COO-2567-6) Avail: NTIS HC A02/MF A01

High resolution mass spectrometry and threshold photoelectron-coincident photoion mass spectrometry of propane-2-13C showed that skeleton isomerization in propane ions precedes the fragmentation of that ion to ethylene ion and methane. Methylnitrite ion was exceptional in its fragmentation near threshold, the products NO+ and CH3O+ are not competitive. Electron range and energy loss for 50 to 500 eV electrons were measured for the rare gases and nitrogen. Isomerization of nitromethane ion to methylnitrite ion appears to be controlled by electronic state correlation. While highly exothermic even at threshold for parent ion formation of nitromethane, dissociation and presumably isomerization to methylnitrite ion occur only from the upper, 2A state of nitromethane ion, which correlates approximately with the 2A state of methylnitrite ion. DOE

N81-22149# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Radiology.
IONIZATION IN LIQUIDS Progress Report, 1 Sep. 1977 - 30 Apr. 1981
G. Bakale and E. C. Gregg 19 Dec. 1980 70 p refs
(Contract DE-AS02-78EV-40746)
(COO-4746-3) Avail: NTIS HC A04/MF A01

A model of direct radiosensitization was developed based on dry charge-carriers having an extended lifetime in the sheath of structured water that surrounds polar biomolecules. In this model, the pre-solvation lifetimes of dry electrons increased with an increase in the rotational times of solvent molecules. During the development of this model, an increasing number of radiosensitizers were found to be carcinogenic. Carcinogens attached quasifree electrons at diffusion-controlled rates. To explore the k/sub e/-carcinogenicity correlation, a study of quasifree electron attachment to the water pools of reversed micelles was conducted. The degree of structuredness of the water pools which determines the k/sub e/ of the reversed micellar systems was also controlled. Another approach to controlling the microenvironment of quasifree electrons in biological systems was done in studies of radiation-induced damage to DNA in concentrated DNA solutions. DOE

N81-22150# California Univ., Livermore. Lawrence Livermore Lab.
COMBUSTION OF REELS OF MAGNETIC TAPES
A. Lipska, S. Priante, D. Beason, H. Ford, and S. Stover 6 Feb. 1981 22 p
(Contract W-7405-eng-48)
(UCID-18976) Avail: NTIS HC A02/MF A01

The flammability of magnetic tape assemblies used at the national fusion energy computer center was investigated. Experimental and large scale tests showed that the magnetic computer tape, reels, and cases decompose at fairly low temperatures. It is also shown that they do not release detectable amounts of corrosive products at low heating rates. Extremely hard to extinguish with water once the assemblies are fully involved. Reignition is probably due to the high heat capacity of the metal oxide in the magnetic tapes. DOE

N81-22151# Brigham Young Univ., Provo, Utah.
INVESTIGATION OF SULFUR-TOLERANT CATALYSTS FOR SELECTIVE SYNTHESIS OF HYDROCARBON LIQUIDS FROM COAL-DERIVED GASES Quarterly Technical Progress Report, 19 Sep. - 18 Dec. 1980
Calvin H. Bartholomew 10 Jan. 1981 29 p refs
(Contract DE-AC01-79ET-14809)
(DOE/ET-14809/5) Avail: NTIS HC A03/MF A01

A 15% iron boride on SiO2 catalyst was prepared using an alcohol solution reduction with NaBH4. The H2 chemisorption measurements were performed for Fe-S-100 and are in progress for the iron-boride-silica catalyst. Reduction of Co catalysts at 623 K rather than 723 K is being tested as a method to improve dispersion by decreasing the amount of Co support interaction. An in depth study of nonolefinic and nonparaffinic compound retention times on the 10% SP2100 chromotograph column has shown that the compounds elute in the following order for a specific carbon number: alkene < alkane < ketone < ester < alcohol < acid. Mass flow controllers were installed in the reactor system and are fully operational. DOE

N81-22152# Northwestern Univ., Evanston, Ill. Dept. of Mechanical and Nuclear Engineering.
THEORETICAL STUDIES ON HETEROGENEOUS COMBUSTION Progress Report, 1 Mar. 1980 - 28 Feb. 1981
Chung K. Law 1981 13 p refs
(Contract DE-AS02-77ER-04433)
(COO-4433-4) Avail: NTIS HC A02/MF A01

Efforts were expended on understanding both droplet and spray combustion. A d(2)-Law for the vaporization and combustion of multicomponent droplets was successfully formulated, and the classical d(2)-Law for single component droplets generalized. It is shown that the classical d(2)-Law, is of significant practical utility because it allows assessment of the droplet lifetime within the combustor. DOE

N81-22153# Brigham Young Univ., Provo, Utah. Combustion Lab.
BASIC COMBUSTION AND POLLUTANT-FORMATION PROCESSES FOR PULVERIZED FUELS Quarterly Report, 1 Oct. - 31 Dec. 1980
Geoffrey J. Germane and L. Douglas Smoot 15 Jan. 1981 30 p refs
(Contract DE-FG22-80PC-30306)
(DOE/PC-30306/T1; QTPR-1) Avail: NTIS HC A03/MF A01

The potential industrial application of pulverized fuels other than coal was investigated. Utilization problems with these fuels such as flame stability, fuel handling, pollutant emission and ash, and slag formation in large scale furnaces were examined. An extensive literature search was conducted to assess current knowledge relative to utilization of these fuels. DOE

N81-22154# Oxford Univ. (England). Engineering Lab.
A LATTICE MODEL FOR MEMBRANE TRANSPORT
W. S. Haworth Jul. 1980 11 p refs
(OUEL-1325/80) Avail: NTIS HC A02/MF A01

A membrane consisting of a cubic lattice of cylinders of diameter d connected at lattice points by cubes of side d, spaced l apart in each orthogonal direction is proposed. This model is physically more valid than other models. Water content and membrane thickness values were used to calculate the d/l ratio. The absolute value of l and hence d was then determined from the measured hydraulic permeability of the membrane and an appropriate theoretical or empirical correlation for the function factor. The diffusivity was next calculated for the size of the diffusing species. Author (ESA)

N81-22155# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.

MODEL INVESTIGATIONS OF TURBULENT DIFFUSION FLAMES

Heinrich Eickhoff Aug. 1980 25 p refs Presented at Workshop on Combust. in Eng., London, Jul. 1980

(DFVLR-Mitt-80-19) Avail: NTIS HC A02/MF A01

Two dimensional diffusion flames were selected to test appropriate turbulence and chemistry models. Modifications of the K-epsilon model are discussed which were developed to account for variable density and polar geometry. To model the chemistry in turbulent diffusion flames, infinitely fast reactions with quenching in the fuel rich region were assumed. The application of the modified K-epsilon model to different free burning jet flames shows the limitations of such an approach. Short time Schlieren pictures explain that it is mainly the more or less orderly flow structure and developing turbulence at the beginning which is influenced by combustion. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-22156 California Inst. of Tech., Pasadena.

ELECTRON ATTACHMENT REACTIONS AND PHOTOCHEMISTRY OF TRANSITION METAL CARBONYLS IN THE GAS PHASE AND ON SURFACES Ph.D. Thesis

Patricia Margaret George 1981 142 p

Avail: Univ. Microfilms Order No. 8107272

Mechanistic studies of photo assisted and electron assisted deposition of thin metal films from organometallic compounds at low pressure were carried out. Various types of spectroscopy and microscopy were used to characterize the complex processes occurring during film formation. The major techniques which were used to evaluate metal films deposited in this manner were Rutherford backscattering spectrometry, X-ray photoelectron spectroscopy and energy dispersive X-ray microprobe analysis. The photoassisted mechanism which involves initiation, propagation, and termination of film growth is detailed. The dissociate electron attachment reactions of transition metal carbonyls are examined. Dissert. Abstr.

N81-22157 Clarkson Coll. of Technology, Potsdam, N.Y.

KINETICS OF ALTERNATING CURRENT ELECTROCHEMICAL AND CORROSION PROCESSES Ph.D. Thesis

S. Venkatesh 1981 454 p

Avail: Univ. Microfilms Order No. 8107071

An experimental investigation of the effect of alternating current (ac) and alternating voltage (AV) on several electrochemical systems and a theoretical analysis of the AC effect on a copper/copper ion system are presented. The electrodeposition of zinc with superimposed AC was examined. The rotating electrode technique was employed to carry out the investigations. The proposed theoretical model for ac modulation on a rotating disk electrode for a metal/metal ion system incorporated the double layer capacitance, the variation in the surface concentration with AC and the ohmic potential. The model predictions gave a qualitative agreement with the experimental results. The reasons for quantitative discrepancies were also discussed. Dissert. Abstr.

N81-22158*# Case Western Reserve Univ., Cleveland, Ohio.

MICROSTRUCTURE AND MECHANICAL PROPERTIES OF BULK AND PLASMA-SPRAYED Y2O3-PARTIALLY STABILIZED ZIRCONIA Annual Report

Peter G. Valentine and Ralph D. Maier Aug. 1980 45 p refs (Grant NsG-3252)

(NASA-CR-165126) Avail: NTIS HC A03/MF 01 CSCL 11F

Bulk 8.0 weight percent yttria partially stabilized zirconia (PSZ) was studied by light microscopy, transmission electron microscopy, X-ray analysis, microhardness testing, and fracture toughness testing. The as received PSZ contained spheroidal and grain boundary precipitates up to 4 micrometers in size. Spheroids up to 1.26 micrometers were metastable tetragonal; large spheroids were monoclinic. Grinding the PSZ into powder did not cause a significant amount of tetragonal to transform to monoclinic. This indicates that transformation toughness is not a significant mechanism in PSZ. Aging the PSZ at 1500 C caused the fine tetragonal precipitates to grow from 0.06 to 0.12 micrometers, in 250 minutes. A peak hardness of 1400 kg/sq mm was attained after 50 minutes. Solution annealing and quenching the as received PSZ eliminated the large precipitates, but fine tetragonal precipitates reformed on quenching. Aging at 1500 C caused the fine 0.02 micrometers tetragonal precipitates to grow into plates about 0.10 by 0.50 micrometers. A peak hardness of 1517 kg/sq mm was obtained after 250 minutes. On further aging, monoclinic percipitates formed along grain boundaries. The fracture toughness of the aged and unaged solution annealed and quenched PSZ was found to be between 2 and 3 MN /square root of m cubed. This range of fracture toughness is consistent with PSZ's that do not undergo transformation toughening. Author

N81-22159*# General Electric Co., Huntsville, Ala.

MPS SOLIDIFICATION MODEL. VOLUME 2: OPERATING GUIDE AND SOFTWARE DOCUMENTATION FOR THE UNSTEADY MODEL

Anna L. Maples Mar. 1981 35 p

(Contract NAS8-33573)

(NASA-CR-161720; GE-81HV001-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 11F

The operation of solidification Model 2 is described and documentation of the software associated with the model is provided. Model 2 calculates the macrosegregation in a rectangular ingot of a binary alloy as a result of unsteady horizontal axisymmetric bidirectional solidification. The solidification program allows interactive modification of calculation parameters as well as selection of graphical and tabular output. In batch mode, parameter values are input in card image form and output consists of printed tables of solidification functions. The operational aspects of Model 2 that differ substantially from Model 1 are described. The global flow diagrams and data structures of Model 2 are included. The primary program documentation is the code itself. E.D.K.

N81-22160*# National Aeronautics and Space Administration, Washington, D. C.

AN ELECTRON-MICROSCOPE STUDY OF ALPHA TO GAMMA TRANSFORMATION IN AN IRON-NICKEL ALLOY

V. A. Lobodyuk, L. G. Khandros, and N. P. Fedas Apr. 1980 12 p refs Transl. into ENGLISH from Metallofizika (Kiev), no. 27, 1970 p 113-120 Original language document was announced as A70-36204 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75824) Avail: NTIS HC A02/MF A01 CSCL 11F

Procedures used to study the alpha to gamma conversion in thin foils of an iron alloy with 32% nickel concentration and initial martensite conversion temperature of -60 C are described. Photomicrographs show deformation twinning as well as changes in samples after they were heated. Reverse conversion is discussed and results are examined. A.R.H.

N81-22161*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF PLASMA SPRAY PARAMETERS ON TWO LAYER THERMAL BARRIER

Stephan Stecura Mar. 1981 22 p refs

(NASA-TM-81724; E-764) Avail: NTIS HC A02/MF A01 CSCL 11F

The power level and the type of arc gas used during plasma

spraying of a two layer thermal barrier system (TBS) were found to affect the life of the system. Life at 1095 C in a cyclic furnace test was improved by about 140 percent by increasing the power during plasma spray applications of the bond and thermal barrier coatings. This improvement is due to increases in the densities of the bond and thermal barrier coatings by 3 and 5 percent, respectively. These increases in densities are equivalent to about 45 and 30 percent reduction in mean porosities, respectively. The addition of hydrogen to the argon arc gas had the same effect as the reduction in power level and caused a reduction in TBS life. Author

N81-22162# Naval Research Lab., Washington, D. C.
FATIGUE CRACK GROWTH IN A36/A283 PLATE IN AIR AND SEA WATER ENVIRONMENTS Interim Report
F. R. Stonesifer and J. M. Krafft 26 Mar. 1981 33 p refs (RR0230345)
(AD-A097034; NRL-MR-4467) Avail: NTIS HC A03/MF A01 CSCL 11/6

Extensive use of A36 type steels in wave-excited marine structures raises the question of its resistance to fatigue crack propagation in the sea water environment. Above its ductile-brittle transition temperature, static fracture of such a low strength steel usually entails extensive plastic deformation. However with cyclic loading, fatigue cracks can grow with little plastic flow, at crack loading levels well below that required for fracture instability. The hazard entailed has the positive benefit of allowing linear elastic fracture mechanics to be utilized in applying test data to problems of structural life prediction. To this end, this paper report crack growth data on A36 plate at laboratory temperature in air and in synthetic sea water. Two extremes of mean stress or stress ratio R=0 and 0.8 typify the ordinary condition as well as growth in the residual stress field of a constrained weld. Varied cyclic frequencies as low as 0.1 Hz reach as low the natural sway frequencies of very large structures at sea. The new data is compared with literature data from other structural steels using fitting parameters of the NRL tensile ligament instability model for crack propagation. Results indicate that no relief from corrosion fatigue effects is derived from the relatively low yield strength level of this steel. GRA

N81-22163# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS Research and Development Status Report, 5 Jun. - 5 Sep. 1980
R. E. Lewis Sep. 1980 22 p
(Contract F33615-78-C-5203; DARPA Order 3417)
(AD-A096483; LMSC-D777825) Avail: NTIS HC A02/MF A01 CSCL 11/6

The objective of this program is to develop advanced aluminum alloys from rapidly solidified particulate that meet specific property goals (A and B). In addition, the program is to establish a metallurgical basis suitable for manufacturing scale-up and application to new weapon systems. Goal A is a 30% increase in specific modulus of elasticity relative to Al 7075-T76, without significant loss in strength, toughness, fatigue strength, or stress-corrosion resistance. Goal B is a 20% increase in specific modulus of elasticity accompanied by a 20% increase in specific strength, without significant loss in toughness, fatigue strength, or stress corrosion resistance. GRA

N81-22164# Illinois Univ. at Urbana. Dept. of Metallurgy and Mining Engineering.
APPLICATION OF RAPID SOLIDIFICATION TECHNIQUES TO ALUMINUM ALLOYS Technical Report, 1 Jul. 1979 31 Jan. 1980
C. G. Lebi and R. Mehrabian Oct. 1980 206 p refs
(Contract N00014-78-C-0275; ARPA Order 3517)
(AD-A096492) Avail: NTIS HC A10/MF A01 CSCL 11/6

This portion of the program was conducted for the purpose of developing a predictive model of heat flow and solidification for aluminum alloys produced under the high cooling rate conditions achievable in atomization processes. It is a combined experimental and theoretical study of the relationship between the important solidification variables (e.g. cooling rate, temperature gradients, interface shape and velocity, supercooling and transformation kinetics) and the structure of rapidly solidified aluminum alloy powders. This report covers that portion of the investigations which addressed the characterization of the thermal history of rapid solidification in metal droplets, and its effects on powder microstructure. The main effort was focused on modelling the heat flow during solidification, and relationships were established between the atomization parameters, the growth kinetics, the interface velocity and undercooling, and other important variables. Numerical solutions based on the enthalpy model were developed, and their results compared to the trends predicted from the Newtonian model. The analysis covered situations of isothermal solidification at the melting temperature, as well as those where significant undercoolings are necessary for nucleation and growth. The implications of single vs. multiple nucleation were also discussed. The concepts developed from the heat flow analysis were coupled to microstructural observations in aluminum alloy powders, mostly in the submicron size range. It was shown that reducing the particle size decreases the extent of segregation, promotes multiple nucleation and the formation of twins during solidification. Homogeneously solidified powders were found in Al 3 percent Si and 6 percent Si below 1 micron in diameter; their incidence is enhanced by reducing the solute content and increasing the heat transfer coefficient. GRA

N81-22165# SRI International Corp., Menlo Park, Calif.
MECHANISMS OF CORROSION OF COPPER-NICKEL ALLOYS IN SULFIDE-POLLUTED SEAWATER Final Report, Feb. 1977 - Feb. 1981
L. E. Eiselstein, R. D. Caligiuri, S. S. Wing, and B. C. Syrett Feb. 1981 71 p refs
(Contract N00014-77-C-0046; NR Proj. 036-116)
(AD-A096865) Avail: NTIS HC A04/MF A01 CSCL 11/6

We have investigated the importance and effects of various variables on the corrosion mechanism of two copper/nickel alloys, CA706 (90%Cu-10%Ni) and CA715 (70%Cu-30%Ni) in seawater. The variables investigated were dissolved oxygen content, sulfide content, pH, flow velocity, sulfide preexposure, various sulfide species, and simultaneous exposure to sulfide and oxygen. The presence of sulfide in seawater was found to prevent formation of the protective corrosion product that normally forms on copper/nickel alloys. Therefore, when both sulfide and oxygen were present in the seawater, the corrosion of the alloys was greatly accelerated. A qualitative model was developed to explain the mechanism of uniform corrosion of copper/nickel alloys in various seawater environments. GRA

N81-22166# Wayne State Univ., Detroit, Mich.
PHOTOCHEMICAL ACTIVATION AND REACTIVITY OF POLYNUCLEAR TRANSITION METAL COMPLEX MOLECULES Progress Report, Jun. 1980 - 31 May 1981
J. F. Endicott and R. L. Lintvedt Jan. 1981 18 p refs
(Contract DE-AS02-78ER-04685)
(DOE/ER-04685/1) Avail: NTIS HC A02/MF A01

A continuing effort to synthesize polynuclear transition metal complexes that exhibit multielectron transfer reactions, can be expected to have long lived excited states, and/or undergo photochemically initiated intramolecular energy transfer to produce reactive species is described. The electrochemical investigation of multielectron transfer reactions of polynuclear transition metal complexes is discussed. The photophysics of binuclear complexes in which electron transfer could take place between a photochemically excited metal ion and the metal ion in the same molecule, thereby producing two new reactive sites, was studied. DOE

N81-22167# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
RADIATION EFFECTS ON BCC METALS AND ALLOYS Final Report, 1 Mar. 1970 - 31 Aug. 1980
J. Moteff Dec. 1980 52 p refs
(Contract DE-AS02-76ER-02093)
(COO-2093-45) Avail: NTIS HC A04/MF A01

In order to contribute to more meaningful and self consistent deformation and/or strengthening models, use was made of quantitative transmission electron microscopy to obtain the number density and size distribution of the various defect states in the irradiated material. With this information, the influence of defects on dislocation mobility and deformation modes was determined. In addition, by means of high temperature anneals for different time intervals, the original defect states were significantly changed so that the above dislocation defect

interaction models may be tested under many different conditions. Combinations of time at temperature and applied stress was shown to be extremely important in the dislocation channeling phenomenon, a circumstance that is closely associated with irradiation induced embrittlement. Detailed resistivity measurements, a technique for determining defect thermal stability and recovery kinetics, was used to establish critical test temperatures. DOE

N81-22168# Lehigh Univ., Bethlehem, Pa. Inst. for Metal Forming.
CRITERION FOR THE PREVENTION OF CORE FRACTURE DURING EXTRUSION OF BIMETAL RODS
B. Avitzur, R. Wu, S. Talbert, and Y. T. Chou Sep. 1980 50 p refs
(Contract DE-AC02-79ER-10367)
(DOE/ER-10367/T2) Avail: NTIS HC A03/MF A01

Based on the upper bound theorem in limit analysis, a theoretical model for core fracture in bimetal rods during extrusion was developed and a fracture criterion established. The variables affecting core fracture are reduction in area (r%); die geometry; friction (m); relative size of the core; and relative strength of the core. Within the wide range of possible combinations of these process variables, only a small range permits extrusion without fracture. With suitable modifications the present analysis is extended to develop criteria for sleeve fracture during extrusion and for both core and sleeve fracture during drawing. DOE

N81-22169# Los Alamos Scientific Lab., N. Mex.
A CRITICAL EVALUATION OF MOLYBDENUM AND MOLYBDENUM AND ITS ALLOYS FOR USE IN SPACE REACTOR CORE HEAT PIPES
L. B. Lundberg Jan. 1981 25 p refs
(LA-8685-MS) Avail: NTIS HC A02/MF A01

The choice of pure molybdenum as the prime candidate material for space reactor core heat pipes is examined, and the advantages and disadvantages of this material are brought into focus. Molybdenum's high ductile brittle transition temperature and modest creep strength place significant design restrictions on a core heat pipe made from it. Molybdenum alloys are examined with regard to their promise as potential replacements for pure molybdenum. The properties of TZM and molybdenum rhenium alloys are examined, and it appears that Mo-Re alloys with 10 to 15 wt% rhenium offer the most advantage as an alternative to pure molybdenum in space reactor core heat pipes. M.G.

N81-22170# Illinois Univ., Urbana. Dept. of Chemical Engineering.
CONDITIONS FOR DROPWISE CONDENSATION ON ELECTROPLATED GOLD Progress Report, 15 Feb. 1980 - 14 Feb. 1981
J. W. Westwater Dec. 1980 5 p refs
(Contract DE-AC02-80ER-10596)
(DOE/ER-10596/1) Avail: NTIS HC A02/MF A01

The use of thin coatings of gold on metal to produce dropwise condensation of steam was further investigated. Dropwise condensation is preferred to filmwise condensation because it has much larger heat transfer coefficients and in ocean thermal energy conversion, could result in dramatic reductions in the size of heat exchangers. Numerous tests were conducted on a variety of electroplated gold surfaces, with and without brighteners, deposited from sulfite and from cyanide solutions. Tests also were made with gold deposited from solution by nonelectrolytic means and with gold deposited from vapor. Additional tests were made with a solid, pure gold test piece subjected to mechanical, chemical, and ion bombardment cleaning procedures. The test surfaces were analyzed chemically by auger spectroscopy and optically by electron microscopy. To date, the tests support a hypothesis that the role of gold is to provide an oxide free surface for tenacious organic adsorption. The work is being expanded to include silver coatings. DOE

N81-22171# Battelle Pacific Northwest Labs., Richland, Wash.
APPLICATION OF LINEAR POLARIZATION TECHNIQUE TO THE MEASUREMENT OF CORROSION RATES IN SIMULATED GEOTHERMAL BRINES
M. J. Danielson Dec. 1980 29 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3534) Avail: NTIS HC A03/MF A01

The linear polarization of polarization resistance (PR) technique was investigated in high and low salinity geothermal brines at 150 and 250 C on a low carbon steel (A53B) and a ferritic stainless steel (E-brite 26-1) with and without the presence of oxygen in the brine. There was good agreement between weight loss data and the results from linear polarization data. Oxygen generally accelerated the corrosion rate, and in the presence of oxygen the usual form of the PR equation must be replaced by the mass transfer equation to predict corrosion rates correctly. Results of the study were compared with the corrosion rate output of commercial PR instrumentation and it was concluded that this instrumentation is adequate for field investigations in which oxygen is absent. However, when oxygen is present, commercial instruments may underestimate actual corrosion rates considerably. DOE

N81-22172# Ames Lab., Iowa.
ALLOY EVALUATION FOR FOSSIL FUEL PROCESS PLANTS (LIQUEFACTION) Annual Report, 1 Oct. 1979 - 30 Sep. 1980
C. M. Woods and T. E. Scott Dec. 1980 77 p
(Contract W-7405-eng-82)
(IS-4758) Avail: NTIS HC A05/MF A01

The mechanical properties of liquefaction process plant dissolver vessel materials in a coal slurry-hydrogen environment are evaluated. The following were studied: fatigue crack growth rates in 2-1/4Cr-1Mo steel; thermal expansion coefficients of A387, 316 SS, and 883 steels; tensile properties of 2-1/4Cr-1Mo steel after exposure to 4000 psig H2 at 1000 or 950 F; corrosion of 2-1/4Cr-1Mo steel by coal slurry-H2 at 800 F and 4000 psig; analysis of coal and coal oil; and phase stability diagrams of Fe, Cr, Mo, and Mn in H2S-H2-C-O. DOE

N81-22173# KMS Fusion, Inc., Ann Arbor, Mich.
FABRICATION OF METAL SHELLS
T. P. OHolleran, T. M. Hendersón, R. L. Downs, and R. L. Nolen 1980 9 p refs Presented at the Am. Vacuum Soc. Conf., Detroit, 13 Oct. 1980
(Contract DE-AC08-78DP-40030)
(KMSF-U-1004; CONF-801037-33) Avail: NTIS HC A02/MF A01

Small hollow metal spheres are needed as targets for particle beam fusion experiments and as the inner fuel container for multishell targets. For the multishell applications, shells fabricated of materials with high atomic numbers, e.g., gold, are of particular interest because they may effectively reduce preheating of the fuel. Because the shells must also contain the fuel mixture (deuterium and tritium) at high pressures, high strength materials, e.g., iron, are also of considerable interest. With the objective of proof of principle several techniques of fabricating shell, of metal or materials containing large fractions of high atomic number elements were investigated. The techniques, experimental results, and their evaluation are presented. DOE

N81-22174# Westinghouse Research and Development Center, Pittsburgh, Pa.
EMBRITTLEMENT OF CR-MO STEELS IN H2S PLUS H2O VAPOR ENVIRONMENT Quarterly Report, 15 May - 15 Aug. 1980
B. J. Shaw 28 Nov. 1980 21 p refs
(Contract DE-AC05-78ET-13513)
(DOE/ET-13513/T7; QR-8) Avail: NTIS HC A02/MF A01

The hydrogen embrittlement susceptibility of commercial Cr-Mo steels is established. This phase consists of two parts. The first is to assess the hydrogen embrittlement characteristics of the steels at conventional strength levels. The second is to measure the hydrogen embrittlement susceptibility of the peak hardness zone (PHZ) in the heat affected zone adjacent to a weld. Since few large weld samples were available, tests were also conducted on plate material heat treated to a higher strength level corresponding to that of the PHZ. E.D.K.

N81-22175# Rockwell International Corp., Golden, Colo. Energy Systems Group.
EXPLORATORY STUDY ON THE FORMABILITY OF BERYLLIUM

R. R. Corle and S. H. Gelles (Gelles, (S. H.) Associates, Columbus, Ohio) 5 Feb. 1981 22 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3023) Avail: NTIS HC A02/MF A01

The hot formability of beryllium metal was investigated. The Fukui cup test which provides a combination of draw and stretch was successfully applied in conjunction with an electrochemically etched grid system to three grades of beryllium sheet. The beryllium grades showed significant differences in formability ranging from essentially non formable for a heavily textured P/M rolled sheet to highly formable for an ingot sheet with intermediate texture. Beryllium sheet produced by slicing from a hot pressed block exhibited intermediate formability which went through maximum at approx. 4000 C. This last material has near random texture and controlled chemistry. Failure, where it occurred, was in the stretch region of the formability samples. No failure was observed in the draw region. DOE

N81-22176# Galaxy, Inc., Washington, D.C.
ADVANCED PROCESSES FOR METALLURGICAL COKE, VOLUME 1
Robert Ware Straus, J. N. Carsey, Gottfried vonBismarck, and Chico Fujishima Dec. 1980 126 p 4 Vol.
(Contract DE-AC03-79SF-10538)
(DOE/SF-10538/T2-Vol-1) Avail: NTIS HC A07/MF A01

The Japanese, the Germans, the French, and the Russians, as well as the U.S. are all conducting research on improved the processes in the following categories; those which can use lower grades and cheaper coals as feedstocks; those which obtain higher energy efficiencies by recapturing heat now lost; those that will meet the increasingly stringent pollution control standards in the US; or processes, or combinations thereof, which reduce the coke rate per ton of steel. The advantages of the overseas processes are shown by the rather spectacular rise in US imports of coke which in less than a decade have risen from less than 200,00 tons to almost 4 million tons per year. The report details what the major countries, Japan, Germany, and France are doing, their expectations for reducing costs, using less costly coals, cutting emissions and developing auxiliary processes. DOE

N81-22177# Galaxy, Inc., Washington, D.C.
ADVANCED PROCESSES FOR METALLURGICAL COKE. VOLUME 2: APPENDICES
Robert Ware Straus, J. N. Carsey, Gottfried vonBismarck, and Chico Fujishima Dec. 1980 128 p 4 Vol.
(Contract DE-AC03-79SF-10538)
(DOE/SF-10538/T2-Vol-2) Avail: NTIS HC A07/MF A01

Material collected in a survey of German coking plants is presented. Topics include: coke for the German steel industry; recent development suitable for retrofitting to existing coke ovens; German research and development programs in this area; automation, i.e., controlled and programmed operation; and emission control from diffuse sources. DOE

N81-22178# Galaxy, Inc., Washington, D.C.
ADVANCED PROCESSES FOR METALLURGICAL COKE. VOLUME 3: APPENDICES
Robert Ware Straus, J. N. Carsey, Gottfried vonBismarck, and Chico Fujishima Dec. 1980 80 p refs 4 Vol.
(Contract DE-AC03-79SF-10538)
(DOE/SF-10538/T2-Vol-3) Avail: NTIS HC A05/MF A01

Material collected in a survey of German coking plants is presented. Topics include: heat recovery in coke ovens and in coke cooling (both dry and wet methods); use of recovered heat to preheat charge; and stamping techniques, blending coals, binders, and briquetting. DOE

N81-22179# Galaxy, Inc., Washington, D.C.
ADVANCED PROCESSES FOR METALLURGICAL COKE. VOLUME 4: APPENDICES
Robert Ware Straus, J. N. Carsey, Gottfried vonBismarck, and Chico Fujishima Dec. 1980 104 p refs 4 Vol.
(Contract DE-AC03-79SF-10538)
(DOE/SF-10538/T2-Vol-4) Avail: NTIS HC A06/MF A01

Material collected in a survey of German coking plants is presented. Topics include: ancit hot briquetting (including blast furnace tests), by-products of ancit process; coal preparation; high volatile coking coals; preheating; briquetting blending; compacting and preheating; short coking time; wet charges; temperature control and heat consumption; supplies of coke; and the Solmer coke oven complex at Fos-sur-Mer. DOE

N81-22180# Thyssen Edelstahlwerke A.G., Krefeld (West Germany). Forschungsinst.
CONTROL OF CHEMICAL COMPOSITION OF NICKEL SUPERALLOYS FOR MICROSTRUCTURAL STABILITY Final Report
Florian Schubert Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 102 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-147; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

Specimens from laboratory melts of the nickel alloys IN 738 LC (ATS 385 DG), IN 597 and IN 939 with variations in chemical composition to obtain different structural stability were subjected to long duration annealing at 700 and 800 C, creep rupture tests at 750, 800, 850 and 900 C; and finally to phase analysis. Specimens of sigma-prone melts show, at 750 C and especially at 850 C, lower stress rupture strength than that of melts with a N sub V number below a critical value. How N sub v calculations can be tailored to an alloy type enabling a prognosis of the long-term behavior of a melt is indicated. Author (ESA)

N81-22181# Stahlwerke Roechling-Burbach, Voelklingen (West Germany). Versuchsanstalt.
POWDER METALLURGICALLY IMPROVED ALLOY Final Report
Erich Kohlhaas and Horst Mueller Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 28 p refs In GERMAN; ENGLISH summary Sponsored by Bungesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-148; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

The suitability of udimet 700 for high temperature applications, e.g., turbine blades, was studied. The required inert processing conditions were tested, then the powders underwent additional degas annealing. How hot isostatic pressing (HIP) as well as subsequent upsetting or extrusion pressing influence creep rupture properties at 760C and 900C was examined. The tensile properties at room temperature obtained after heat treatment correspond to the values given in the literature. However, satisfactory creep rupture properties could only be achieved by a two-stage HIP process (1080 C for 2 hr and 1250 C for 4 hr). Author (ESA)

N81-22182# Stahlwerke Roechling-Burbach, Voelklingen (West Germany). Versuchsanstalt.
MICROSTRUCTURAL STABILITY OF NICKEL BASE ALLOYS AT HIGH TEMPERATURES Final Report
Erich Kohlhaas and Horst Mueller Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-149; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

The gas turbine materials Inconel 718 and Waspaloy were submitted to long duration creep rupture tests at 650 C and 750 C as well as 670 C and 730 C, respectively. The creep test specimens were then examined as to their microstructure. Inconel 718, after 8517 hr at 650 C, exhibits no significant structural changes except for a coarser grained gamma prime and gama double prime phase. The alloy is subject to very rapid aging at a temperature of 700 C. After 7102 hr, coarse agglomerated delta phase appears in the grain boundary area. Large areas around the grain boundaries are free from hardening phase precipitations and the interior of the grains mainly exhibits delta phase in a Widmannstatten pattern. Author (ESA)

N81-22183# Hamburg Univ. (West Germany). Lehrstuhl fuer Ingenieurwissenschaften.
PRIMARY CRYSTALLIZATION OF A HYPEREUTECTIC ANTIMONY-SILVER ALLOY UNDER REDUCED GRAVITY. A MELTING EXPERIMENT OF THE TEXUS 1 PROJECT Final Report

Hans Ahlborn Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-32; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

Primary crystals are formed on Earth in a melt float due to gravity segregation and thermal convection. This movement is believed to favor the growth of the primary crystals. Whether primary crystals growing without gravity induced movement and therefore by diffusion only are smaller in size was determined. Results confirm that no gravity driven segregation occured, but the primary crystals homogeneously distributed in the specimen are bigger than those formed in a specimen solidified under the influence of gravity. Moreover, the flight sample is found to have a very fine eutectic structure. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-22184 Wisconsin Univ. - Madison.
VISCOELASTIC PROPERTIES OF DILUTE POLYMER SOLUTIONS AND POLYMER-LOADED OILS Ph.D. Thesis
Barry Gene Brueggeman 1980 356 p
Avail: Univ. Microfilms Order No. 8028173

The intrinsic high frequency viscosity for poly(4-vinylbiphenyl) in Aroclor 1248 is found to be 15 ml/g. The viscoelastic properties of several polymer loaded oils were measured, and the steady state compliance of the oils at 25.0 C was found to be independent of polymer concentration and the viscosity of the base oil, but strongly dependent upon polymer type and molecular weight. No correlation was found between the steady state viscosity of these polymer loaded oils and their steady state compliance.
Dissert. Abstr.

N81-22185 Georgia Inst. of Tech., Atlanta.
OXIDATIVE PYROLYSIS STUDIES OF SYNTHETIC POLYMERS Ph.D. Thesis
Russell Otis Gardner 1980 184 p
Avail: Univ. Microfilms Order No. 8107283

A system, compatible wiah gas chromatography (GC) and gas chromatography mass spectroscopy (GCMS) was investigated that would allow analysis of the pyrolyzates present as free gases and those associated with the particulates when synthetic polymers are thermally decomposed in the presence of air. Factors affecting the reproducibility of the oxidative pyrolysis/collection system, were also investigated. Included among these were pyrolysis cell temperature and heating rate, desorption temperature employed for removal of associated compounds from the particulates; collection trap temperature; injection procedures; filter absorbent effect and chromatographic parameters. The system was successfully employed, using packed and capillary columns, in both GC and GCMS experiments. Dissert. Abstr.

N81-22186 California Univ., Irvine.
CONTROLLED INTRODUCTION OF FUNCTIONALITY IN A SYNTHETIC POLYMER Ph.D. Thesis
Evan Allan Thompson 1980 110 p
Avail: Univ. Microfilms Order No. 8106793

Functionality was introduced into highly crosslinked, macroreticular polymers by the template synthesis method. The method commenced with compolymerization of a bis-vinylbenzyl ester of a dicarboxylic acid, called the template unit, and commercial divinylbenzene. Subsequent hydrolytic removal of the dicarboxylic acid left attached to the polymer two benzyl alcohol moieties per molecule of hydrolyzed estere. The stereochemical relationship between the two benzyl groups was predetermined by the size and shape of the bridging dicarboxylic acid of the ester. This relationship was retained following hydrolytic cleavage, as was demonstrated by specific rebinding of dicarboxylic acids.
Dissert. Abstr.

N81-22187 Texas A&M Univ., Galveston.
LIGAND ABSORBING POLYMERS IN HOMOGENEOUS HYDROGENATION Ph.D. Thesis
Marian Stager Bursten 1980 198 p
Avail: Univ. Microfilms Order No. 8107994

The application of polymeric reagents as selective triorganophosphine absorbers was developed. Absorption of triorganophosphines by macroreticular silver(I) - exchanged sulfonated polystyrene (PS-SO3Ag) was studied. Addition of PS-SO3Ag and ethylene to a solution of RhCl(PPh3)3, introduction of alkene, and removal of ethylene resulted in increased hydrogenation rates for some alkenes. Addition of PS-SO3Ag to solutions of RhH(CO)(PPh3)3, RuH(OAc)(PPh3)3, and RuH2(PPh3)4 led to increased alkene hydrogenation rates. A method for the crystallization of the extremely insoluble RuCl2(PPh3)2(NBD) involved the passage of NBD-saturated Ar vapor over a CH2Cl2 solution of RuCl2(PPh3)4; this results in slow crystal deposition. The crystal structure of RuCl2(PPh3)2(NBD) was determined.
Dissert. Abstr.

N81-22188 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE CONCENTRATION DEPENDENCE OF THE PARTITION COEFFICIENT FOR MACROMOLECULES IN POROUS MEDIA Ph.D. Thesis
Judeth Helen Brannon 1980 230 p
Avail: Univ. Microfilms Order No. 8107872

Partitioning of macromolecules between pore and bulk solutions directly affects both equilibrium and transport processes such as exclusion chromatography and the movement of solutes through pores. The equilibrium partition coefficient relates the concentration of macromolecules in the pores that in the bulk solution. Because of interactions between the macromolecules and the pore wall, the change in the macromolecule activity with concentration is different in the pore than in the bulk. This difference causes a concentration dependence of the partition coefficient as seen in experiments involving exclusion chromatography. The theoretical development of the concentration dependent partition coefficient using statistical mechanical and numerical methods, and the experimental determination of the concentration effects on the partition coefficient for bovine serum albumin and three dextrans of different molecular weights are included. Dissert. Abstr.

N81-22189 Oklahoma Univ., Norman.
APPLICATION OF ELECTROCHEMICAL TECHNIQUE TO MEASURE MASS TRANSFER OF MACROMOLECULES IN A FLOW SYSTEM Ph.D. Thesis
Uthman Mohammed Dawoud 1980 124 p
Avail: Univ. Microfilms Order No. 8107957

The electrochemical technique was used to study the mass transfer rates of macromolecules in a flow system. The direct oxidation of NADH was the electroactive species. The flow system consisted of rectangular duct. Glassy carbon disc electrodes were used as the working electrodes. A platinum sheet was used as the counter electrode, and the reference electrode was Ag/AgCl. The Reynolds numbers were 7174, 10782, and 14307. The Schmidt number was held constant at 4730. Steady state voltammetry and the scanning methods were used to obtain voltammograms (current potential curves) with well defined mass transfer regions. Dissert. Abstr.

N81-22190*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER SURFACE FUSION OF PLASMA SPRAYED CERAMIC TURBINE SEALS Patent Application
Donald W. Wisander and Robert C. Bill, inventors (to NASA) Filed 11 Mar. 1981 11 p
(NASA-Case-LEW-13269-1; US-Patent-Appl-SN-242795) Avail: NTIS HC A02/MF A01 CSCL 07C

An abradable lining that is deposited on a shroud forming a gas path seal in turbomachinery is described. Improved thermal shock resistance is effected through the deliberate introduction of microcracks which will not propagate appreciably upon exposure to the thermal shock environment in which a turbine seal must function. The microcracks are introduced by laser surface fusion treatment of the ceramic. The ceramic surface is laser scanned to form a continuous dense layer. As this layer cools and solidifies, shrinkage results in the formation of a very fine crack network

which precludes the formation of a catastrophic crack during thermal shock exposure. J.D.H.

N81-22191*# Idaho Univ., Moscow. Dept. of Chemical Engineering.
PERFLUOROETHER TRIAZINE ELASTOMERS Final Report, 1 Mar. 1980 - 28 Feb. 1981
Roger A. Korus 28 Feb. 1981 9 p refs
(Grant NsG-2367)
(NASA-CR-164194) Avail: NTIS HC A02/MF A01 CSCL 07C

The synthesis of high performance elastomers with the high thermal stability and chemical, inertness of perfluoroalkylene triazine and a low glass transition temperature is discussed. Perfluorether triazine elastomers were proposed as potentially superior. It is concluded that the difficulties experienced in fluoroalkytriazine elastomer synthesis can be overcome by a four-step reaction process involving chain extension, triazine ring closure, crosslinking, and elastomer curing. Molecular weight can be controlled in the initial polymer formation so that elastomer modulus can be determined. The final product elastomers exhibit a useful elastomeric range of approximately 45 to 325 C with an oxidative stability superior to other broad range elastomers. M.G.

N81-22192*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF URETHANE COATING AND POTTING MATERIAL WITH IMPROVED HYDROLYTIC AND OXIDATIVE STABILITY
Donald E. Morris Mar. 1981 47 p refs
(NASA-TM-82408) Avail: NTIS HC A04/MF A01 CSCL 07C

A series of saturated hydrocarbon based urethanes was prepared and characterized for hydrolytic and oxidative stability. A series of ether based urethanes was used as a basis for comparison. The alkane base urethanes were found to be hydrolytically and oxidatively stable and had excellent electrical properties. The alkane based materials absorbed little or no water and were reversion resistant. There was little loss in hardness or weight when exposed to high temperature and humidity. Dielectric properties were excellent and suffered little adverse effects from the high temperature/humidity conditions. The alkane based urethanes were not degraded by ozone exposure. Author

N81-22193*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRON REFLECTION AND SECONDARY EMISSION CHARACTERISTICS OF SPUTTER-TEXTURED PYROLYTIC GRAPHITE SURFACES
Edwin G. Wintucky, Arthur N. Curren, and James S. Sovey 1981 18 p refs Presented at the Intern. Conf. on Met. Coatings, San Francisco, 6-10 Apr. 1981; sponsored by AVS
(NASA-TM-81755; E-818) Avail: NTIS HC A02/MF A01 CSCL 11D

Low secondary and reflected primary electron emission from the collector electrode surfaces is important for optimum collector efficiency and hence for high overall efficiency of microwave amplifier tubes used in communication satellites and in military systems. Ion sputter texturing of the surface effectively suppresses electron emission from pyrolytic graphite, which is a promising collector electrode material. Secondary and reflected primary electron emission characteristics of sputter textured pyrolytic graphite surfaces with microstructures of various sizes and densities are presented. The microstructure with the lowest electron emission levels, less than those of soot, consists of a dense array of tall, thin spires. E.D.K.

N81-22194# Pittsburg Univ., Pa. Dept. of Metallurgical and Materials Engineering.
FLAMMABILITY: TOXICITY RATING OF SOME POLYPHOSPHAZENE AND POLYURETHANE FOAMS Interim Technical Report
P. J. Lieu, J. H. Magill, and Y. C. Alarie 19 Feb. 1981 40 p refs
(Contract N00014-77-C-0310; NR Proj. 356-644)
(AD-A096595; SETEC-MME-80-062; ITR-6) Avail: NTIS HC A03/MF A01 CSCL 11/9

The toxicity of the degradation products in air of several polyphosphazenes have been tested using mice. Douglas Fir was used as a reference material in these screening studies, made under dynamic air flow conditions where the sample was heated at 35C/min (or 20C/min) up to 700C. LC sub 50 results were obtained from % mortality - concentration response curves. Gas analysis determination were also made for HCN, CO and total oxides of nitrogen (Expressed as NO2). Chemical analysis complements the animal studies, although other toxic substances (under study) may be responsible for some of the toxicity. Potential Hazard Index is being considered for several materials where all the parameters are available. Based upon this index, polyphenoxyphosphazenes are ranked as less hazardous than GM polyurethanes. Scanning electron microscopy of the polyphosphazene chars and energy dispersive analysis of these residues were useful in estimating char porosity, filler distribution as well as chemical changes associated with thermo-oxidative and other reactions. GRA

N81-22195# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
DEFORMATION OF AMORPHOUS Fe40Ni40P14B6 UNDER COMPRESSION TO 250 KBAR
H. Kimura, D. G. Ast, and W. A. Bassett 5 Mar. 1981 25 p refs
(Contract N00014-77-C-0546; Grants NSF EAR-79-19978; NSF EAR-78-04388; NR Proj. 039-151)
(AD-A096887; TR-5) Avail: NTIS HC A02/MF A01 CSCL 11/2

Metallic glass was compressed in the diamond cell to 250 kbar and the pressure was measured as a function of position with the ruby method. Analysis of P(r) yields a flow stress of 17 kbar, and pressure dependence of 0.4% per kbar. The pressure dependence is similar to that of crystalline Fe. GRA

N81-22196# Ceramic Finishing Co., State College, Pa.
LOCALIZED IMPACT DAMAGE IN CERAMICS: COMPARISONS OF RECENT EXPERIMENTS AND THEORETICAL CALCULATIONS
H. P. Kirchner and T. J. Larchuk Jul. 1980 64 p refs
(Contract N00014-74-C-0241; NR Proj. 032-545)
(AD-A096947) Avail: NTIS HC A04/MF A01 CSCL 11/2

The objective of the present investigation is to make a comprehensive experimental evaluation of a recent theory of elastic-plastic impact and to modify the theory to provide a more realistic description of the impact characteristics. Previous work has included investigation of subsonic localized impact damage in glass, ZnS, transformation toughened zirconia (TT-2rO2), and other ceramics. A major advantage of the theory is that it provides a means to predict the response of a material subjected to impact loading using contact characteristics determined by static loading tests. The assumption that the damage induced at a particular maximum static load is the same as that resulting from an equal maximum impact load has frequently been invoked or suggested. A recent report describes similarities and differences in damage induced by static and impact loading. A preliminary evaluation of the theory of elastic-plastic impact using limited data showed that the theory yields promising results. The present report describes certain modifications of the theory and a more complete evaluation of the theory based on more extensive data. GRA

N81-22197# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
PHYSICAL AGING OF LINEAR AND NETWORK EPOXY RESINS
James E. McGrath, A. K. Banthia, Y. Mohajer, M. R. Tant, and Eric Siu-Wai Kong 13 Mar. 1981 34 p refs
(Contract N00014-78-C-0629)
(AD-A097017; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/9

Network and linear epoxy resins principally based on the diglycidyl either of bisphenol-A and its oligomers have been prepared and studied. Both diamine and anhydride crosslinking agents were utilized. In addition some rubber modified epoxies and a carbon fiber reinforced composite were investigated. All of these materials display time-dependent changes in many of their properties when they are stored (following quenching) at

temperatures below their glass transition temperature (sub-T sub g annealing). For example, the degree of stress relaxation for a given time period is observed to decrease in a linear fashion with the logarithm of time during sub-T sub G annealing. Young's modulus and yield stress were also found to increase in physical aging. Solvent sorption experiments initiated after different sub-T sub G annealing times have demonstrated that the rate of solvent uptake can be indirectly related to the free volume of the epoxy resins. Water affecting the physical aging of these epoxy resins was not found to be a significant variable. Residual thermal stresses were also found to have little effect on the physical aging process, although this variable was not studied in detail. GRA

N81-22198# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
AN OVERVIEW OF THE NONEQUILIBRIUM BEHAVIOR OF POLYMER GLASSES
M. R. Tant and G. L. Wilkes 13 Mar. 1981 94 p refs
(Contract N00014-78-C-0629; NR Proj. 356-692)
(AD-A096682; TR-4) Avail: NTIS HC A05/MF A01 CSCL 11/9

An overview is given of the nonequilibrium behavior of polymeric glasses. While the emphasis is to display the significant effects of the nonequilibrium behavior on observable properties, some general basics of the glass transition behavior and nonequilibrium behavior are also presented. Both molecular as well as phenomenological explanations of the nonequilibrium phenomenon are considered. The overview is not meant to be exhaustive but has the principal objective to introduce and educate the newcomer to this topic of polymer science. GRA

N81-22199# Cambridge Univ. (England). Cavendish Lab.
DEFORMATION AND THERMAL PROPERTIES OF ENERGETIC MATERIALS Final Report
J. E. Field, M. M. Chaudhri, G. M. Swallowe, and Tong B. Tang Dec. 1980 67 p refs
(Grant DA-ERO-76-G-073; DA Proj. 1T1-61102-BH-57)
(AD-A096771) Avail: NTIS HC A04/MF A01 CSCL 11/9

The report covers four areas of work. In the first it is shown that some polymers can sensitize explosives in impact situations. The effect is primarily a mechanical one with the production of free radicals by the polymer only of secondary importance. Chemical effects were assessed using TG. High speed photography, with the sample between transparent anvils, was used to photograph impacts on polymers, explosives and layers of explosive with polymers added. Polymers which sensitize are those which fail catastrophically, either by fracture or localized adiabatic shear, and which have a low specific heat, latent heat, and thermal conductivity. Hot spots in these polymers during rapid deformation can greatly exceed the polymers softening point. This was confirmed by separate experiments with a friction apparatus with hot spot temperatures recorded using IR techniques. The second study describes a graphical computer method for analysing TG and DSC traces which gives all three reaction parameters (E,A,n) characterizing an nth order reaction from a single trace. The final areas of research described are concerned with the analysis of (1) isothermal kinetic data and (2) dynamic kinetic data from solid state reactions. GRA

N81-22200# General Atomic Co., San Diego, Calif.
CERAMIC MATERIALS FOR FUSION REACTORS Interim Report
G. Hopkins, G. C. Trantina (GE, Schenectady, N.Y.), and J. Corelli (Rensselaer Polytechnic Inst.) Feb. 1981 165 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 992)
(EPRI-AP-1702) Avail: NTIS HC A08/MF A01

Materials studies identified siliconized silicon carbide as the most promising material. It has a long term service limit of 12000 C and can be fabricated in large shapes. Its strength and Weibull modulus do not decrease significantly at 12000 C after fast neutron irradiation up to a fluence of 1.2 x 10(25) n/m(2). However, its thermal conductivity is reduced markedly during irradiation. Laboratory tests show that this affects the thermal shock resistance of silicon carbide adversely. How this will change the design of silicon carbide first walls remains to be evaluated. DOE

N81-22201# Polytechnic Inst. of Bucharest (Rumania).
STUDY OF CHEMICAL NON-HOMOGENEITY OF THE POLYMERS, USING AS INFORMATION SOURCE THE PARAMETERS OF EQUIPARTITION EQUILIBRIUM OF THE ISOTOPES Final Report
R. Vilcu Jun. 1980 3 p Sponsored by IAEA
(IAEA-R-1826-F) (US Sales Only) HC A02/MF A01; DOE Depository Libraries

A computer program was developed to calculate the equipartition equilibrium of labelled polymer molecules in the use of radioisotope tracers for the studies of chemical nonhomogeneity of vinylic copolymer systems: MM-NA-CVD; MM-S-CVD; NA-S-CVD; and MM-NA-S-CVD, where CVD represents vinylidene chloride, MM methyl methacrylate, NA acrylonitrile and S styrene. DOE

N81-22202# American Chemical Society, Springfield, Va. Div. of Industrial and Engineering Chemistry.
NATIONAL SYMPOSIUM ON POLYMERS IN THE SERVICE OF MAN: 6TH STATE-OF-THE-ART SYMPOSIUM Final Report
1980 194 p refs Symp. held at Washington, D.C., 9-11 Jun. 1980 Sponsored in part by Navy
(Grant AF-AFOSR-0220-80; AF Proj. 2303)
(AD-A096998; AFOSR-81-0159TR) Avail: NTIS HC A09/MF A01 CSCL 11/5

An overview session traced polymer development in the U.S., presented the status of polymer science in Europe and Japan, and addressed the role of polymers in meeting energy problems. Experts presented invited papers in technical sessions and engineering plastics, conventional fibers, high performance fibers, composites, and coatings. The symposium was attended by 200 scientists, engineers, and executives from industry, universities, institutes, and government. GRA

N81-22203# KMS Fusion, Inc., Ann Arbor, Mich.
CHEMICAL DURABILITY IMPROVEMENT OF GLASS SHELLS
P. R. Anderson, L. A. Scott, and J. J. Rolen 1980 18 p refs Presented at the Am. Vacuum Soc. Conf., Detroit, 13 Oct. 1980
(Contract DE-AC08-78DP-40030)
(KMSF-U-1011; CONF-801037-35) Avail: NTIS HC A02/MF A01

High temperature chemical surface treatments were used to improve the chemical durability and weatherability of spherical glass shells. The surface treatment consists of exposing heated glass shells to a mixture of sulfur dioxide, air and water vapor. A thin layer of the glass shell was dealkalized as a result of this treatment. The weatherability of treated alkali-silicate and alkali-calcia, silicate shells was improved, as determined qualititatively with the aid of a scanning electron microscope. The chemical durability of silicate shells containing over 10 wt. percent alkali but no calcia was improved by as much as a factor of thirty by the treatment. The chemical durability of glass shells was determined by analyzing the aqueous solutions used for extracting the constituents of the shells. Treated glass shells containing calcia showed greater resistance to dissolution in water than untreated glass shells of the same composition, even though the untreated shells were relatively durable. DOE

N81-22204# KMS Fusion, Inc., Ann Arbor, Mich.
STRENGTH OF ALUMINUM-CONTAINING GLASS SHELLS
W. J. Miller, R. L. Downs, L. A. Scott, and R. G. Schneggenburger 1980 8 p refs Presented at the Am. Vacuum Soc. Conf., Detroit, 13 Oct. 1980
(Contract DE-AC08-78DP-40030)
(KMSF-U-1009; CONF-801037-31) Avail: NTIS HC A02/MF A01

Under external gas pressure glass shells appear to fail by buckling. This implies a glass composition-strength correlation since composition determines Yound's modulus, a property directly proportional to buckling failure stress. For tensile loads produced in gas filled shells, the effect of composition on glass strength is more indirect. Aluminum-containing glass was chosen as a composition which is resistant to at least some of the currently recognized strength reducing mechanisms. The buckling strength

of glass shells containing aluminum is reported and compared to strength of glass shells with no aluminum. DOE

N81-22205# Sandia Labs., Albuquerque, N. Mex.
ANALYSIS OF EPOXY RESIN FORMULATIONS BY C-13 NMR SPECTROSCOPY
R. A. Assink and F. T. Gurule Feb. 1981 25 p refs
(SAND-80-2564) Avail: NTIS HC A02/MF A01

The chloroform soluble components of several epoxy resin formulations were analyzed by C-13 NMR spectroscopy. The technique permits the components of an epoxy resin formulation to be identified on a routine basis with a high degree of confidence. Narmco's 5208 contained MY-720 and EpiRez SU-7 or SU-8. Two versions of Ferro's CE-9000 contained ERL-0510 and EpiRez SU-7 or SU-8. Although the method is semiquantitative, it was able to distinguish between the two versions of Ferro's CE-9000 in which the concentration of ERL-0510 differs by approximately a factor of two. DOE

N81-22206# Siemens A.G., Munich (West Germany). Forschungslab.
SPACE CHARGERS IN POLYMERS Final Report
Bernhard Andress, Peter Fischer, Kurt Nissen, and Peter Roehl Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 129 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-036; ISSN-0340-7608) Avail: NTIS HC A07/MF A01

A nondestructive method for the determination of space charges in polyethylene was developed. Direct measurement shows that electrons are injected into polyethylene. No difference in the space charge buildup is observed when different contacting metals or semiconducting polymer electrodes are used. During ac stressing, space charges build up very gradually in the polymer, but any influence on the breakdown strength is not registered even after long duration prestressing at high average field strengths. It seems more probable that physical/chemical changes account for the observed decrease in breakdown strength with time. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-22207 Utah Univ., Salt Lake City.
FLUIDIZED BED HYDRODESULFURIZATION OF COAL DERIVED LIQUIDS Ph.D. Thesis
Hsiang-Yun Arthur Kung 1980 148 p
Avail: Univ. Microfilms Order No. 8106876

A bench-scale continuous 1 inch I.D. fluidized bed reactor system was built. Two feedstocks were used: a petroleum heavy gas oil and a coal derived liquid from Tacoma, Washington. The heavy gas oil (280-389 C) was used to adjust the system, and the coal derived liquid (SRC II 200-509 C) was used to determine the effect of process variables. The catalyst was a commercial cobalt-molybdenum oxide supported on alumina ground to 49 micron size. The catalyst was sulfided prior to use. The dew point temperatures and hydrogen/oil feed ratio were determined such that vapor-phase operation could be maintained for the desired range of operation. Minimum fluidization velocities with high pressure and high temperature conditions were experimentally determined by measurement of the pressure drop through the bed of solid particles. The overall hydrodesulfurization reaction fitted a pseudo-second-order rate equation with respect to sulfur concentration at constant total pressure. The activation energy of hydrodesulfurization of SRC-II liquid ranged from 14.9 to 15.5 Kcal/g mole. Dissert. Abstr.

N81-22208 Missouri Univ. -Rolla.
CULTURE STUDIES ON THE CONVERSION OF CORN STOVER TO METHANE Ph.D. Thesis
Gary Lynn Foutch 1980 182 p
Avail: Univ. Microfilms Order No. 8108118

The anaerobic fermentation of corn stover to methane was demonstrated to be a viable process for the conversion of this agricultural residue to a useable form of energy. With fresh cow manure as the original inoculum, digestors were operated over a period of four years at retention times varying between 20 and 100 days. A first order reaction rate constant of 0.045 per day was determined as was a maximum conversion at infinite retention of 73 percent. Several bacteria were examined to determine their ability to produce better conversion of sugars and corn stover to methanogenic substrates. Dissert. Abstr.

N81-22209# Naval Weapons Center, China Lake, Calif.
DECOMPOSITION AND INTERACTION OF PROPELLANT INGREDIENTS Annual Progress Report, 1 Oct. 1979 - 30 Sep. 1980
K. J. Kraeutle and T. L. Boggs 30 Sep. 1980 9 p refs
(AD-A096807) Avail: NTIS HC A02/MF A01 CSCL 21/9

Investigated were decomposition, deflagration, and interaction of conventional and new propellant ingredients with the goal of improving performance and safety, reducing cost to achieve specified performance, and providing methods to assure reproducibility during production and usage. GRA

N81-22210# Chem Systems, Inc., Fairfield, N.J. Research and Development Group.
DEVELOPMENT OF ALCOHOL-BASED SYNTHEIC TRANSPORTATION FUELS FROM COAL-DERIVED SYNTHESIS GASES Quarterly Progress Report, 1 Apr. - 30 Jun. 1980
3 Dec. 1980 48 p
(Contract DE-AC22-79ET-14858)
(DOE/ET-14858/3; QPR-3) Avail: NTIS HC A03/MF A01

Fourteen catalysts were prepared by either evaporation of metal nitrate-citric acid solutions or by impregnation of inert supports with metal nitrate-citric acid solutions and were tested in either the Berty gradientless reactor or the plug flow reactor. Although none of the catalysts tested resulted in reaching the targeted oxygenates selectivities and space time yields, the following relevant observations were made: potassium in a catalyst having the formula Cu Zn0.125CoA0.11 is a better alkali promoter than cesium, impregnation of inert supports with metal nitrate citric acid solutions reduced activity and oxygens productivity in comparison to the unsupported catalyst and mechanical blending of metal oxides for a CuZn0.125CoCrK0.11 results in better selectivity conversion characteristics than coprecipitation or evaporation of nitrate-citric acid solutions. DOE

N81-22211# South Carolina Energy Research Inst., Columbia. Div. of Energy Resources.
FUEL ETHANOL AND SOUTH CAROLINA: A FEASIBILITY ASSESSMENT. VOLUME 1: EXECUTIVE SUMMARAY
Jul. 1980 37 p refs
(Contract DE-FG44-80R4-10075)
(DOE/R4-10075/T1-Vol-1) Avail: NTIS HC A03/MF A01

The production of fuel grade ethanol from grain and other carbohydrate based resources was investigated. The building of ethanol production plants to produce alternate fuels which can be burned directly in modified engines or mixed with gasoline to make gasohol is discussed. Information about the production of ethanol in small scale and major commercial facilities in South Carolina is reported. The existing carbohydrate resource base in the state, extent to which the base can be increased, and out of state feedstocks to expand the base are reviewed. The economic impact, environmental impact, state requirements, use of agricultural residues, and manure derived methane are examined. E.A.K.

N81-22212# South Carolina Energy Research Inst., Columbia.
FUEL ETHANOL AND SOUTH CAROLINA: A FEASIBILITY ASSESSMENT. VOLUME 2: DETAILED REPORT
Jul. 1980 252 p refs
(Contract DE-FG44-80R4-10075)
(DOE/R4-10075/T1-Vol-2) Avail: NTIS HC A12/MF A01

Productional ethanol from carbohydrates in the state of South Carolina is discussed. Ethanol fuels become a more significant element in South Carolina's energy mix. The existing carbohydrate resource base in the state is reviewed, the extent to which this base can be increased is estimated, and importation of out of

state feedstocks to expand the base further is discussed. The economics of ethanol production for farm scale and commercial sized plants, environmental impacts, and state permitting and approval requirements are discussed. The use of agricultural residues and manure derived methane to fuel the ethanol production process is addressed. DOE

N81-22213# California Univ., Livermore. Lawrence Livermore Lab.
SOME RECENT EFFORTS TOWARD HIGH DENSITY IMPLOSIONS
Gene E. McClellan 4 Dec. 1980 51 p Presented at the Gordon Conf. on Laser Interaction with Matter, Tilton, N.H., 13 Aug. 1979
(Contract W-7405-eng-48)
(UCRL-84380; CONF-7908139-1) Avail: NTIS HC A04/MF A01

Recent efforts towards achieving high density implosions are presented. The implosion dynamics necessary to compress DT fuel to 10 to 100 times liquid density are discussed. Methods of diagnosing the maximum DT density for a specific design are presented along with results to date. The dynamics of the double shelled target with an exploding outer shell are described, and some preliminary experimental results are presented. DOE

N81-22214# Los Alamos Scientific Lab., N. Mex.
THREE-DIMENSIONAL MODELING OF TRIPLE-WAVE INITIATION OF INSENSITIVE EXPLOSIVES
Charles L. Mader and James D. Kershner Feb. 1981 10 p refs
(Contract W-7405-eng-36)
(LA-8655) Avail: NTIS HC A02/MF A01

The initiation of propagating detonation in the insensitive explosive PBX 9502 (95/5 TATB/Kel-F at 1.894 g/cu cm) by triple shock wave interaction from three initiators was modeled using the three dimensional, reactive, Eulerian hydrodynamic code, 3DE. The forest fire burn model of heterogeneous explosive shock initiation was used to model the explosive decomposition. DOE

N81-22215# Los Alamos Scientific Lab., N. Mex.
JET INITIATION OF EXPLOSIVES
Charles L. Mader and George H. Pimbley Feb. 1981 11 p refs
(Contract W-7405-eng-36)
(LA-8647) Avail: NTIS HC A02/MF A01

The initiation of propagating detonation in PBX 9502 and PBX 9404 by jets of copper, aluminum, and water is numerically modeled using the two dimensional Eulerian hydrodynamic code 2DE with the shock initiation of heterogeneous explosive burn model called Forest Fire. The Held experimental critical condition for propagating detonation is the jet velocity squared times the jet diameter. In PBX 9502, the jets initiate an overdriven detonation smaller than the critical diameter, which either fails or enlarges to greater than the critical diameter while the overdriven detonation decays to the C-J state. In PBX 9404, the jet initiates a detonation that propagates only if it is maintained by the jet for an interval sufficient to establish a stable curved detonation front. DOE

N81-22216# Pittsburg and Midway Coal Mining Co., Englewood, Colo.
SOLVENT REFINED COAL (SRC) PROCESS Progress Report
Dec. 1980 18 p
(Contract DE-AC01-76ET-10104)
(DOE/ET-10104/T8) Avail: NTIS HC A02/MF A01

The progress of the solvent refined coal (SRC) project during the month of October, 1980 is summarized. The Fort Lewis pilot plant was shut down the entire month for inspection and maintenance. The process development unit P-99 completed two runs investigating potential start-up modes for the demonstration plant. E.D.K.

N81-22217# Los Alamos Scientific Lab., N. Mex.
SOME IMPLICATIONS OF ACCELERATED SYNTHETIC FUELS DEVELOPMENT IN THE ROCKY MOUNTAIN STATES
Verne Loose Nov. 1980 25 p refs
(LA-8588-MS) Avail: NTIS HC A02/MF A01

A regionalized national energy model is used to examine the air quality and water quantity implications of accelerated synthetic fuels development. Several alternate targeted output levels are analyzed. Generally, the results indicate that a relatively large synthetic fuels industry (2.5 million bbl/day) could be located within the Rocky Mountain and Northern Great Plains States within the confines of water availability and air quality legislation. Author

N81-22218# Battelle Pacific Northwest Labs., Richland, Wash.
TRANSPORTATION FUELS FROM WOOD
E. G. Baker, D. C. Elliott, and D. J. Stevens 1980 14 p refs
(PNL-SA-8584; CONF-801210-18) Avail: NTIS HC A02/MF A01

The various methods of producing transportation fuels from wood are evaluated. These methods include direct liquefaction schemes such as hydrolysis/fermentation, pyrolysis, and liquefaction. Indirect liquefaction techniques involve gasification followed by liquid fuels synthesis such as methanol synthesis or the Fischer-Tropsch synthesis. The cost of transportation fuels produced by the various methods are compared. In addition, three ongoing programs dealing with liquid fuels from wood are described. E.D.K.

N81-22219# Chicago Univ., Ill.
COAL TRANSFORMATION CHEMISTRY Quarterly Report, 1 Jun. - 31 Aug. 1980
L. M. Stock 1980 26 p refs
(Contract DE-AC22-80PC-30088)
(DOE/PC-30088/2; QPR-2) Avail: NTIS HC A03/MF A01

A proposed structure for bituminous coal is given. The facts concerning reduction, reductive alkylation, hydrogen atom exchange, oxidation, functional group analysis were used to define a structural segment consisting of about 1000 atoms with a molecular weight in excess of 6000. The reductive alkylation reaction of Illinois No. 6 coal in liquid ammonia was directed toward the optimization of the reaction conditions for the achievement of maximum solubility. About 55% of the original Illinois No. 6 coal can be converted to products which are soluble in tetrahydrofuran using potassium in liquid ammonia as the reducing agent and n-butyl iodide in tetrahydrofuran as the reducing alkylating agent. The effort on donor solvent coal chemistry was directed to the role played by pericyclic reactions in the liquefaction process. The reactivity of a number of donors was examined including 1,2- and 1,4-dihydronaphthalene. Free radical processes occur preferentially. The pericyclic reactions appear to be unimportant at the threshold reaction temperatures of 350 to 4250 C. DOE

N81-22220# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
FLASH HYDROPYROLYSIS OF COAL Quarterly Report, 1 Jan. - 31 Mar. 1980
Meyer Steinberg, Peter Fallon, and Bharat L. Bhatt Aug. 1980 27 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51293; QR-12) Avail: NTIS HC A03/MF A01

Experiments were conducted using Pittsburgh No. 8 and Illinois No. 6 bituminous coals. Diluents of limestone, sand, CaO and K2Co3 were used to prevent agglomeration. No significant effect on product yield was observed for the various diluents. A significantly greater fraction of naphthalene was found in the heavy liquids from the bituminous coals than from the lignite and subbituminous coal. Models of the subbituminous data indicate good correlation with the experimental results. Thermodynamic equilibrium calculations indicate that the rapid hydrogasification of coal is not equilibrium controlled. DOE

N81-22221# Battelle Columbus Labs., Ohio.
SYNTHETIC FUEL AROMATICITY AND STAGED COMBUSTION Quarterly Technical Progress Report, 23 Sep. - 31 Dec. 1980
Arthur Levy, James R. Longanbach, and Lisa K. Chan 28 Jan. 1981 21 p refs
(Contract DE-AC22-80PC-30302)
(DOE/PC-30302/1; QPR-1) Avail: NTIS HC A02/MF A01

Methods for determining aromaticity and preliminary pyrolysis experiments are described. Middle and heavy distillates of a sample of SRC-II (solvent refined coal) were analyzed for elemental nitrogen, molecular weight and aromatic distribution was determined, and a simulated distillation by gas chromatography was performed. The drop tube apparatus to be used for the pyrolysis studies for the determination of the aromaticity and fuel-bound nitrogen as a function of time, temperature, and oxygen level is described. Preliminary pyrolysis experiments to determine the collection efficiency of the apparatus, the importance of drop size, and the effect of the gas flow were performed. J.D.H.

N81-22222# Colorado School of Mines, Golden. Dept. of Chemical and Petroleum Refining Engineering.

PHASE EQUILIBRIUM PROPERTIES OF COAL-DERIVED LIQUIDS Technical Progress Report, Jul. - Dec. 1980

V. F. Yesavage and A. J. Kidnay 1 Jan. 1981 10 p refs
(Contract DE-FG22-80PC-30230)
(DOE/PC-30230/T1) Avail: NTIS HC A02/MF A01

A major difficulty associated with measuring phase behavior of complex mixtures is the need to characterize the vapor and liquid sample products. This generally requires the collection of considerable quantities ot the liquid and vapor products. Of all the methods listed, the only method which can generate significant quantities of both liquid and vapor products is the once-through flow method. This method was used previously in determining the K values for petroleum fractions. For these reasons, a flow equilibrium flash vaporization system similar to the ones previously used on petroleum liquids was designed. DOE

N81-22223# Oklahoma State Univ., Stillwater. School of Chemical Engineering.

CATALYSTS FOR UPGRADING COAL-DERIVED LIQUIDS Quarterly Report, 1 Oct. - 31 Dec. 1980

Billy L. Crynes 14 Jan. 1981 22 p refs
(Contract DE-AC22-79ET-14876)
(DOE/ET-14876/T1) Avail: NTIS HC A02/MF A01

Progress on catalyst evaluations is reported. As part of the investigation of throwaway and zoned catalyst systems, a method for the determination of asphaltene content in coal derived liquids is described, the weight percent hydrogen in the product oil was determined, and the boiling points of feedstocks were determined. In catalyst life studies, three catalysts or catalyst combinations were evaluated and the representation of catalyst activity decay as a linear relationship is given. Runs made with shell 324 NiMo/Al catalyst are reported. At Exxon Donor Solvent (EDS) process feed oil/EDS raw solvent feedstock was rather easily hydrotreated. The highly hydrogen deficient Solvent Refined Coal extract (SRC-I)/prehydrogenated creosote oil resulted in rapid coking. Regeneration of the catalyst used in an earlier experimental run is described. J.D.H.

N81-22224# TRW Systems Group, Redondo Beach, Calif.

PROGRAMMED TEMPERATURE GASIFICATION STUDY Final Report, 1 Oct. 1979 - 30 Nov. 1980

M. J. Spoon, M. P. Gardner, J. A. Starkovich, H. L. Fein, and A. J. Apte 30 Nov. 1980 102 p refs
(Contract DE-AC21-79MC-11630)
(DOE/MC-11630/T1) Avail: NTIS HC A06/MF A01

An experimental, modeling and conceptual engineering analysis study was performed to assess the feasibility of a Programmed Temperature Gasification (PTG) concept for carbonizing caking coals without severe agglomeration. The concept involves control of carbonizing heating rate to maintain metaplast concentration at a level equal to or slightly below that which causes agglomeration. The experimental studies required construction of a programmed temperature, elevated pressure, hot stage video microscope for observation of coal particle changes during heating. This system was used to develop a minimum-time heating schedule capable of carbonizing the coal at elevated pressures in the presence of hydrogen without severe agglomeration. Isothermal fixed heating rate data for a series of coals were subsequently used to calibrate and verify the mathematical model for the PTG process. DOE

N81-22225# Sandia Labs., Livermore, Calif.

HEAVY OIL PROGRAM Quarterly Progress Report, 1 Apr. - 30 Jun. 1980

J. R. Wayland Dec. 1980 33 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2215) Avail: NTIS HC A03/MF A01

Preliminary activities in the survey of sand control, drilling, and fracturing techniques in heavy oil formations are described. The continued development of a high temperature packer for use in steam injection applications is presented. An application of controlled source audio magnetotelluric survey to developing thermal fronts from in situ combustion and steam drive is described. DOE

N81-22226# Department of Energy, Washington, D. C. Assistant Secretary for Resource Applications.

TRENDS IN REFINERY CAPACITY AND UTILIZATION: PETROLEUM REFINERIES IN THE UNITED STATES, FOREIGN REFINERY EXPORTING CENTERS

E. L. Peer, F. V. Marsik, and J. F. Hutchins Dec. 1980 86 p
(DOE/RA-0010-Rev-12-80) Avail: NTIS HC A05/MF A01

The United States and foreign refining capacities are examined with emphasis on the growth of domestic crude oil distillation and downstream processing capacities. The growth of foreign refineries in countries which are capable of exporting products to the United States are also discussed. These data can be used to evaluate planned growth in U.S. and foreign refinery capacities to give a perspective on the U.S. product import situation. DOE

N81-22227# California Univ., Livermore. Lawrence Livermore Lab.

UNDERGROUND COAL GASIFICATION SITE SELECTION AND CHARACTERIZATION IN WASHINGTON STATE AND GASIFICATION TEST DESIGNS

R. Stone and R. W. Hill 10 Sep. 1980 61 p refs
(Contract W-7405-eng-48)
(UCRL-53052) Avail: NTIS HC A04/MF A01

A site in the Tono Basin of the Centralia-Chehalis district containing subbituminous coal in two deeply buried seams (the Lower Thompson and the Big Dirty) was found to be suitable for underground coal gasification (UCG) experiments and possible commercial development. Eight exploratory boreholes and two test wells were drilled to provide the primary subsurface geologic and hydrologic information. A series of surface gasification tests using large blocks of coal cut free of the Big Dirty seam in mine exposures will be conducted to establish a preliminary set of in situ operational parameters-air injection pressures, flow rates, and coal consumption rates. If the site is suitable, the surface gasification tests will be followed by two deep underground gasification experiment - one employing borehole linking and the other reverse combustion-linking. DOE

N81-22228# UOP, Inc., Des Plaines, Ill. Process Div.

COAL LIQUID/PETROLEUM REFINERY INTEGRATION

George A. Gilder and Vance P. Burton 1980 23 p refs Presented at the 45th Midyear Refining Meeting, Houston, Tex., 15 May 1980
(Contract DE-AC01-77ET-10131)
(FE-2566-43; CONF-8005115-1; Preprint-38-80) Avail: NTIS HC A02/MF A01

The economic feasibility of coprocessing H-Coal liquid and petroleum in a typical large refinery is evaluated. Existing technology can be applied to coprocess H-Coal liquid and petroleum; it is economically feasible when the value of the H-Coal liquid is about equivalent to the value of the imported crude oil. Because of the initial investment required to handle the H-Coal liquid, the processing economics are more favorable at 5% or 10% than at 3% H-Coal liquid concentration. DOE

N81-22229# Missouri Univ. -Rolla.

GASIFICATION RESEARCH ON WOOD GROW PROJECT

V. J. Flanigan 9 Jan. 1981 47 p ref
(Contract DE-AC02-79ET-23029)
(DOE/ET-23029/T3) Avail: NTIS HC A03/MF A01

The GROW (gasification research on wood) project consists of a research project on thermochemical degradation of wood particles on a pilot plant and utilizes a 100 cm diameter fluidized sand bed reactor at capacities of up to 1000 Kg/Hr. Supplementary facilities include wood preparation and air conveying, a wood feed bin, feed and transfer screws, an air compressor

with storage and filter tanks, an electrical preheater, a propane fired preheater, a cyclone separator removing solids from product gas, a water scrubber to cool and clean product gas, a scrubber water settling tank, a scrubber water cooler, a knockout drum, a demister to be installed in the future, a recycle compressor for recirculation, a recycle gas storage tank, a flare and stack with air blower to dispose of the gas, two CO2 stripper columns to be installed in the future to remove CO2 by caustic adsorption, caustic tanks, and the necessary piping, pumps, sampling, and measurement facilities. A brief report of progress on the project is given, followed by the safety implementation plan and operating, maintenance, and safety procedures. DOE

N81-22230# United Technologies Corp., South Windsor, Conn. Power Systems Div.

DEVELOPMENT OF THE ADIABATIC REFORMER TO PROCESS NO. 2 FUEL OIL AND COAL-DERIVED LIQUID FUELS Interim Report

W. E. Houghtby, R. F. Busell, J. A. S. Bett, R. R. Lesieru, A. P. Meyer, J. L. Preston, and H. J. Setzer Feb. 1981 82 p refs

(EPRI Proj. 1041-4)

(EPRI-EM-1701) Avail: NTIS HC A05/MF A01

Testing was conducted primarily in a 2 inch diameter, bench scale reactor. First, the configuration of the nozzle in which fuel, steam and air were mixed before entering the catalyst bed was optimized. Next, holding the nozzle geometry constant, the effect of variation of the catalyst was studied. A bench scale reactor incorporating the optimized nozzle and improved catalysts ran stably for 450 hours. The performance met the goals for 4.8 MW phosphoric acid fuel cell power plant at a 9300 Btu/kWh heat rate for all conditions except operating pressure which was 45 psia. Two pilot scale, 6 inch diameter adiabatic reformers were built, each with a fuel air mixing nozzle scaled up from the best configuration identified in the bench scale reactors. The performance of the bench and pilot scale reactors agreed within a nominal scatter which defined the ability to scale up the design. Brief tests in the optimized bench scale reactor gave an assessment of the capability of the adiabatic reformer to process coal derived liquid fuels. DOE

N81-22231# Pittsburg and Midway Coal Mining Co., Shawnee Mission, Kans.

EXPLORATORY RESEARCH ON SOLVENT-REFINED COAL LIQUEFACTION Quarterly Technical Progress Report, 1 Jul. - 30 Sep. 1980

Feb. 1981 44 p

(Contract DE-AC22-79ET-14800)

(DOE/ET-14800/25) Avail: NTIS HC A03/MF A01

Disposable catalysts and the effect of specific additives in both the SRC I and SRC II processing modes were investigated. At 4500 C, 2250 psig and 1.0 hour residence time with Loveridge coal in the SRC II mode, yields and hydrogen consumptions were essentially the same for runs with 5 wt % added pyrite or 3.3 wt % added ferric oxide. When Loveridge coal was impregnated with 0.7 wt % molybdenum, slightly higher oil yields and slightly lower hydrocarbon gas, SRC and IOM yields were obtained than with the iron compounds above. When Loveridge coal was processed in the SRC I mode at 4500 C, 1900 psig and 26 minutes residence time, there was a 3.7% increase in total oil yield with a corresponding decrease in SRC yield when pyrite was added to the feed slurry. There was a smaller effect with a FeS2/Fe2O3 combination and little or no effect when ferric oxide alone was added. DOE

N81-22232# Weber State Coll., Ogden, Utah.

ROLE OF THE HYDROGEN-DONOR SOLVENT IN COAL HYDROLIQUEFACTION Progress Report, 1 Sep. 1979 - 30 Nov. 1980

R. R. Beishline 25 Jul. 1980 10 p refs

(Contract DE-AC02-79ER-10510)

(DOE/ER-10510-/T2) Avail: NTIS HC A02/MF A01

The principal disproportionation products of 1,2-dihydronaphthalene (1,2-DHN) are naphthalene (Nap) and tetralin (Tet). Dimers of 1,2-DHN constitute 17% and 5% of the respective liquid phase (285 to 3150 C) and gas phase (385 to 4100 C) products. The Nap:Tet ratio is one in the presence of solvents, but is > 1 and < 2 in their absence. Gas phase reaction kinetics indicate that 1,2-DHN disappears by simultaneous first and second order reactions. These results are consistent with a concerted second order disappearance of 1,2-DHN to produce equal amounts of Nap and Tet, accompanied by eigher carbonium ion or free radical side reactions that produce more Nap than Tet, together with 1,2-DHN dimers. Preliminary evaluation of the liquid phase kinetics suggest they follow a similar pattern. DOE

N81-22233# Exxon Research and Engineering Co., Linden, N.J. Products Research Div.

IMPROVING LOW TEMPERATURE PROPERTIES OF SYNTHETIC DIESEL FUELS DERIVED FROM OIL SHALE: ALTERNATIVE FUELS UTILIZATION PROGRAM

J. W. Frankenfeld and William F. Taylor Nov. 1980 91 p refs

(Contract DE-AC01-79CS-50019)

(DOE/CS-50019/1) Avail: NTIS HC A05/MF A01

The ability of additives to improve the cold flow properties of shale oil derived fuels boiling in the diesel fuel range was evaluated. Because a commercial shale oil industry did not exist to provide actual samples of finished fuels, a representative range of hydroprocessed shale oil fractions was prepared for use in the additive testing work. Crude oil shale was fractionated to give three liquids in the diesel fuel boiling range. The initial boiling point in each case was 325OF (163OC). The final boiling points were 640OF (338OC), 670OF (354OC) and 700OF (371OF). Each fraction was hydrotreated to three different severities (800, 1200 and 1500 psi total pressure) over a nickel molybdate on alumina catalyst at 710 to 750OF to afford 9 different model fuels. A variety of commercial and experimental additives were evaluated as cold flow improvers in the model fuels at treat levels of 0.04 to 0.4 wt percent. Both the standard pour point test and a more severe low temperature flow test were employed. DOE

N81-22234# SRI International Corp., Menlo Park, Calif. Materials Research Lab.

SHIFT CONVERSION AND METHANATION IN COAL GASIFICATION: BENCH-SCALE EVALUATION OF A SULFUR-RESISTANT CATALYST Final Report

B. J. Wood, J. G. McCarty, D. Sheridan, C. M. Ablow, and H. Wise 24 Oct. 1980 79 p refs

(Contract DE-AC21-78ET-11030)

(DOE/ET-11030/T1) Avail: NTIS HC A05/MF A01

Results are presented which demonstrate that the Ir-promoted Ni/Al2O3 catalyst possesses several valuable and superior characteristics when used for catalytic methanation under typical industrial conditions. These properties include: higher activity by a factor of > 2 than that of the unpromoted Ni/Al2O3 catalyst; enhanced resistance to deactivation by hydrogen sulfide during exposure to contaminated feedstock, as manifested by the prolonged high methanation activity and extended service lifetime; and high resistance to carbon fouling. DOE

N81-22235# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.

METHANOL AND METHYL FUEL CATALYSTS Final Technical Report, Sep. 1978 - Aug. 1980

K. Klier and R. G. Herman 15 Dec. 1980 116 p refs

(Contract DE-AC22-78ET-10741)

(DOE/ET-10741/T1) Avail: NTIS HC A06/MF A01

The Cu/ZnO methanol synthesis catalysts were investigated for: (1) the role of additives such as alumina, ceria, and lanthana; (2) the effect of carbon dioxide in the H2/CO synthesis gas; (3) the chemisorption of hydrogen and carbon monoxide on the catalysts; and (4) the chemical poisoning of the catalysts by sulfur and chlorine containing compounds. Maximum activity and selectivity were obtained with a binary catalyst having a composition of Cu/ZnO = 30/70 metal atomic percent and with a synthesis gas of H2/CO/CO2 = 70/28/2 volume percent in the absence of strongly reducing or strongly oxidizing chemical poisons. Both the binary and the ternary catalysts were fully characterized by scanning transmission electron microscopy (STEM), X-ray diffraction, electron spectroscopy, diffuse reflectance spectroscopy, and surface area pore distribution measurements. Structural and morphologic information is presented in this report in detail for very active Cu/ZnO/Al2O3 catalysts prepared from

acetates and for other catalysts in which the third component caused a loss of activity. DOE

N81-22236# Worcester Polytechnic Inst., Mass.
KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Quarterly Report, Apr. - Jun. 1980
A. H. Weiss, Wilmer L. Kranich, and Kemal Gueruez 25 Sep. 1980 6 p
(Contract DE-AS01-77ET-10618)
(DOE/ET-10618/T1) Avail: NTIS HC A02/MF A01

The basic chemical kinetics and mechanisms in catalytic hydrogenation of lignite suspended in a carrier oil in a continuous reactor operating at steady state were investigated. Emphasis was placed on the overall conversion rate and the elemental transformation from the raw materials into products under surface reaction controlling conditions. The reaction mechanisms of hydroliquefaction and hydrogasification of lignite were postulated based upon the results obtained. DOE

N81-22237# Massachusetts Inst. of Tech., Oak Ridge, Tenn. School of Chemical Engineering Practice.
ETHANOL PRODUCTION BY ZYMOMONAS MOBILIS IN A TAPERED-BED BIOREACTOR
R. Sitchin, P. F. Gubanc, J. V. Tormo, Jr., and C. H. Byers, ed. ORNL Feb. 1981 25 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-320) Avail: NTIS HC A02/MF A01

The fermentation of glucose to ethanol by the bacterium zymomonas mobilis was studied. A tapered bioreactor containing an anion exchange resin, to which bacteria were attached, was fluidized by feed solution at 350 C. Short residence times characteristic of the experimental tapered reactor were necessary to model various differential segments of a hypothetical large scale reactor. A feed concentration of 10% glucose as well as glucose/ethanol mixtures were studied. Ethanol production ranged from 29 g/liter/h for a feed containing 2% weight per volume glucose to 64 g/liter/h for a 10% glucose feed. Development of biomass concentration measurement techniques was begun. Caustic stripping, DNA analysis, and dehydrogenase determinations were attempted, but results were inconclusive. DOE

N81-22238# Oak Ridge National Lab., Tenn. Chemistry Div.
MODELING OF GAS SORPTION KINETICS IN COAL
T. B. Irwin, A. M. Grosset, and J. S. Sood Mar. 1981 65 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-305) Avail: NTIS HC A04/MF A01

Transient and equilibrium sorption characteristics of water on Texas lignite coal were measured in the pressure range of 1.2 to 2.3 kPa water pressure. In comparing the current work with that of previous investigators, it was found that only the current study achieved a close approach to equilibrium. Of the several modeling procedures attempted, a model proposed by Debelak, combining Fickian diffusion and adsorption, provided the firmest theoretical ground as well as reasonably good correlation. A mass-action kinetic approach gave excellent correlation. Simple Fickian diffusion and an empirical first-order mode were less successful. DOE

N81-22239# Massachusetts Inst. of Tech., Oak Ridge, Tenn. School of Chemical Engineering Practice.
SEPARATION OF WATER-ETHANOL MIXTURES BY SORPTION, PART 2
R. W. Hone, M. Lamarchand, and W. Malaty ORNL Feb. 1981 30 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-304-Pt-2) Avail: NTIS HC A03/MF A01

As an alternative to distillation for concentrating fuel grade ethanol from dilute aqueous solutions, adsorption from solutions at room temperature was studied using two sorbents: a Rohm and Haas copolymer resin (Amberlite XAD-4) and a proprietary molecular sieve. Both adsorption and desorption (in the latter case with N2) were performed in a packed column. Breakthrough curve analysis indicated that the adsorption capacities matched expectation at the higher flow rates (0.13 g EtOH/g XAD-4 and 0.1 g EtOH/g) molecular sieve. An evaluation of the elution performance revealed that the ethanol passed through a maximum concentration of only 43 wt % ethanol for XAD-4, and 65 wt % for the molecular sieve. Based on the low ethanol concentrations in the liquid condensed from the eluate, it was concluded that there was significant water adsorption on both sorbents and that the feasibility of the process is severely compromised by this fact. DOE

N81-22240# Los Alamos Scientific Lab., N. Mex.
CATALYTIC COAL CONVERSION SUPPORT: USE OF LASER-FLASH PYROLYSIS FOR STRUCTURAL ANALYSIS Progress Report, 1 Sep. - 31 Dec. 1979
W. J. Verzino, Jr., N. E. Vanderborgh, M. A. Fletcher, and B. A. Nichols Feb. 1981 15 p refs
(Contract W-7405-eng-36)
(LA-8369-PR) Avail: NTIS HC A02/MF A01

The gaseous products observed from the neodymium laser pyrolysis of coal appear to be generated out of the highly energetic plasma. Neodymium laser pyrolysis in helium, hydrogen, or deuterium atmospheres did not affect the product distribution. Deuteration of the pyrolysis product was observed when deuterium was used as the carrier gas. High speed photography visualized the explosive interaction of the neodymium laser beam with the coal pellet. The plasma generated during this event and its direction of propagation are clearly shown. Similar gaseous pyrolysis products are observed with neodymium laser pyrolysis of five different ranks of coal. Laser pyrolysis with a continuous wave CO2 laser produced a significantly larger number of components than did the neodymium laser. There is little similarity between the pyrolysis products obtained with the neodymium and those obtained with the continuous wave CO2 laser. DOE

N81-22241# Battelle Columbus Labs., Ohio.
THERMOPHYSICAL PROPERTIES OF COAL LIQUIDS Quarterly Technical Status Report, 1 Oct. - 31 Dec. 1980
J. W. Droege, G. H. Strickford, R. Venkateswar, and S. P. Chauhan 18 Feb. 1981 30 p
(Contract DE-AC22-79ET-14941)
(BMI-2076; QTSR-5) Avail: NTIS HC A03/MF A01

Results are shown for constant temperature viscosity determinations in the gel region of a coal solvent slurry. The data are approximated by a Bingham plastic model. Both plastic viscosity and yield stress pass through peaks near 575 to 600 K. The properties depend on time and temperature. Results are also shown for density determinations. The data appear to be valid up to about 600 K. Some thermal conductivity results are shown. DOE

N81-22242# Bituminous Coal Research, Inc., Monroeville, Pa.
TEST AND EVALUATE OF THE TRI-GAS LOW-Btu COAL GASIFICATION PROCESS Interim Report, Oct. 1979 - Sep. 1980
Dec. 1980 32 p
(Contract DE-AC21-78ET-10254)
(FE-10254-86; BCR-L-1149) Avail: NTIS HC A03/MF A01

Work done to develop the tri-gas fluidized bed gasification process is described. A total of 11 tests were conducted: seven with Rosebud seam coal (a noncaking coal) and four with Illinois No. 6 seam coal (a mildly caking coal). With one exception, the system was operated with the char and gas flows integrated in the process design mode. Smooth transfer of char and gas between reactors was accomplished. During the third test, all three reactor heaters failed. These were of the ribbon type and had been in service for about one year. The damage was such that the heaters had to be completely rebuilt. Because there was insufficient heater ribbon (Chromel A) to rebuild all of the heaters, only the heater for Stage 1 was repaired. Heaters of a different design were installed in Stages 2 and 3 using Globar type silicon carbide heating elements. The new design has the advantage of being simpler to install because of the reduced number of elements. New silicon carbide liners were cast for all three reactor vessels. Extensive cold model testing of new probes was conducted. Mathematical models of the tri-gas process were developed. DOE

N81-22243# Spectron Development Labs., Inc., Costa Mesa, Calif.
EXPERIMENTAL INVESTIGATION OF SYNFUEL SPRAY CHARACTERISTICS AND COMBUSTION DYNAMICS

Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1980
Jan. 1981 40 p refs
(Contract DE-AC22-80PC-30299)
(DOE/PC-30299/T2; SDL-81-2176-04Q) Avail: NTIS HC A03/MF A01

The design and construction of the cold spray rig is reported. Air flow, fuel flow, and optical requirements were identified. These provided the basis for sizing the spray chamber, air flow ducting, blowers, fuel system, and general optical configurations. Detailed design of major systems was completed. In addition to the planned design and assembly work on the cold spray rig, preliminary laboratory experiments were conducted to help define the optical configuration for both the droplet sizing interferometry measurements and the holographic imaging of the (injector) spray formation region. Monodispersed droplet generation techniques and oil burner designs for the generation of spray flames needed were also addressed. DOE

N81-22244# Ellis (George S.), Chardon, Ohio.
ETHANOL PRODUCTION BY VAPOR COMPRESSION DISTILLATION Interim Report, 26 Aug. 1980 - 1 Feb. 1981
George S. Ellis 1981 10 p
(DOE/R5-10240/01) Avail: NTIS HC A02/MF A01

A one gallon per hour vapor compression distillation unit was demonstrated for fuel ethanol production that can be profitably manufactured and economically operated by individual family units. Significant results and observations are reported. DOE

N81-22245# Union Carbide Corp., Tonawanda, N.Y.
INDUSTRIAL OXYGEN PLANTS: A TECHNOLOGY OVERVIEW FOR USERS OF COAL GASIFICATION-COMBINED-CYCLE SYSTEMS Final Report
R. F. Drnevich, E. J. Ecelbarger, and J. W. Portzer Jan. 1981 87 p Sponsored by Electric Power Research Inst.
(EPRI Proj. 239-6)
(EPRI-AP-1674) Avail: NTIS HC A05/MF A01

An overview of the technology associated with commercial oxygen production is presented with focus on the technical and economic aspects that may be important in gasification combined cycle power plant applications. The manual provides an excellent summary of the following topics: history of industrial oxygen production, oxygen plant process, oxygen plant equipment, process control, plant operation and reliability, economics of oxygen production, and environmental, safety, and health considerations. A major concern of many electric utilities is the safety of oxygen plants. The manual contains a detailed discussion of how identification and control of hydrocarbon vapors in air feed has resulted in modern industrial oxygen plants that are characterized by hazard free operation. DOE

N81-22246# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
CROSSED REACTION NETWORKS IN THE CATALYTIC HYDRODENITROGENATION OF SYNTHETIC LIQUID FUELS
C. N. Satterfield and S. Hsi 1980 10 p refs
(Contract DE-AC22-80PC-30075)
(DOE/PC-30075/2; QR-2) Avail: NTIS HC A02/MF A01

The gas feed control system, liquid feed system, the trickle bed reactor a gas liquid separator and sampling system, and automatic safety features were constructed. The gas chromatograph, Perkin Elmer Sigma 1B, was received and tested. The theoretical background for design of the laboratory trickle bed reactor is given in detail. DOE

N81-22247# Institute of Gas Technology, Chicago, Ill.
SYNTHETIC FUELS FROM US OIL SHALES: A TECHNICAL AND ECONOMIC VERIFICATION OF THE HYTORT PROCESS Quarterly Report, 1 Apr. - 30 Jun. 1980
Nov. 1980 96 p refs
(Contract DE-AC01-79ET-14102)
(DOE/ET-14102/1) Avail: NTIS HC A05/MF A01

Thermobalance tests were conducted on samples of shale from each large multiton sample prior to large scale tests and these test results were fit with specific kinetic expressions. Approximately 80 percent of the instrumentation for the laboratory scale reactor was received. Fabrication of the reactor, feed hopper, and residue receiver is about 95 percent complete. Two successful moving bed tests were conducted in the bench scale reactor. A large, 50 ton sample of the Lower Huron member of the Ohio Shale was mined and readied for shipment. Modification of the bench scale steam oxygen unit was completed. Spent shale from PDU tests was prepared for use in these tests. A set of five screening runs on New Albany shale oil and a set of four screening runs on Sunbury shale oil were conducted. DOE

N81-22248# Arizona State Univ., Tempe.
CONVERSION OF CELLULOSIC WASTES TO LIQUID HYDROCARBON FUELS Progress Report, Jan. - Feb. 1981
James L. Kuester 1981 5 p refs Sponsored by DOE
(COO-2982-66) Avail: NTIS HC A02/MF A01

The following materials were processed through gasification: sugarcane bagasse, smooth sumac, coralberry, wild bergamot, pokeweed, cornstarch, Portugese oak cork, and hog fuel. A data summary is given. The high H2/CO ratio at low temperature for pokeweed is of significance. Also the high olefin content of Portugese oak cork (commercial cork) is of major interest. The most promising feedstock to date with regard to synthesis gas composition was guayule cork. A comparison of data for the two cork materials is given. A detailed breakdown for corn starch is given revealing an exceptionally high methane content (35.50 mole percent). DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-22249 Vanderbilt Univ., Nashville, Tenn.
INVESTIGATION OF SPLICE-PLATE CONNECTIONS WITH MULTIPLE BOLT ROWS BETWEEN THE BEAM FLANGES Ph.D. Thesis
Vuddagiri Radha Krishna 1980 272 p
Avail: Univ. Microfilms Order No. 8108284

Splice-plate connections subjected to high moments require larger bolt areas and thus more bolt rows to accommodate a larger number of smaller size bolts. Yield line mechanisms considering the presence of the beam web, were developed to determine the plate thickness. An analytical bolt model for estimating the maximum bolt force was also developed. A design parameter based on the above mechanisms and bolt model was proposed. A computer program was written to carry out the necessary computations and a sensitivity study was conducted to study the effects of the location of bolts and number of bolt rows. A parameter study was conducted by two dimensional finite element analysis and from the results prediction equations were developed for estimating connection rotation, critical plate stress, and bolt forces at any desired load level. Five prototype specimens with plate thicknesses designed according to the proposed procedure were tested, and data on the rotation, plate strains, beam strains near the connection, bolt forces, and deflections were obtained. Dissert. Abstr.

N81-22250 Texas A&M Univ., College Station.
BUILDING CLIMATOLOGY: A CLIMATIC CLASSIFICATION FOR SINGLE FAMILY, SINGLE STORY, RESIDENTIAL BUILDING DESIGN Ph.D. Thesis
Gary Lynn Porter 1980 281 p
Avail: Univ. Microfilms Order No. 8108038

Stress conditions were analyzed for 64 stations from Texas, North America, and Africa. The potential influence of temperature, solar radiation, atmospheric humidity, wind, and precipitation, were analyzed in terms of human comfort. Based on the frequency of conditions falling into various zones (Hot and Humid; Comfortable; etc.) design solutions were suggested that would result in optimum comfort conditions and energy savings. Geographic regions were established that reflect common design conditions in accordance with the climatic conditions.
Dissert. Abstr.

N81-22251*# IIT Research Inst., Chicago, Ill.
MANUFACTURING APPLICATIONS TEAM (MATeam) Quarterly Report, 1 Aug. - 31 Oct. 1979

Edmund R. Bangs 31 Oct. 1979 14 p
(Contract NAS8-32229)
(NASA-CR-161696; QR-3) Avail: Issuing Activity CSCL 13H

Manufacturing Applications Team (MATeam) Technology was transferred in the form of an early-warning bearing failure system. Preliminary Research and Technology Objectives and Plan (RTOP) program activity was initiated in the development of a biodigestion industrial methane gas generator. RTOP support activity continues in the area of ion beam technology. MATeam demonstrated a computerized welding system and presentations were given to selected industrial sources. S.F.

N81-22262# Goad (Ronald R.), Evansville, Ind.
HEAT POWERED REFRIGERATION COMPRESSOR Semiannual Technical Report
Ronald R. Goad 1981 81 p
(Contract DE-FG02-80R5-10221)
(DOE/R5-10221/1) Avail: NTIS HC A05/MF A01

This prototype will be of similar capacity as the compressor that will eventually be commercially produced. This unit can operate on almost any moderate temperature water heat source. This heat source could include such applications as industrial waste heat, solar, wood burning stove, resistance electrical heat produced by a windmill, or even perhaps heat put out by the condenser of another refrigeration system. DOE

N81-22263# Oak Ridge National Lab., Tenn. Computer Sciences Div.
SIMULATION OF FOUR PURE CONDUCTION PARAFFIN-WAX FREEZING EXPERIMENTS
R. Deal (Kalamazoo Coll., Mich.) and A. D. Solomon Jan. 1981 37 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-74) Avail: NTIS HC A03/MF A01

Four freezing experiments with N-Octadecane paraffin wax are described. Their results are analyzed using a variety of mathematical techniques for conduction phase-change problems. It is concluded, among other things, that the effective thermal conductivity of the solid wax in this case is about 3.5 times the literature value. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-22254 California Univ., San Diego.
THE TRANSEQUATORIAL PROPAGATION OF VERY LOW FREQUENCY RADIOWAVES Ph.D. Thesis
Floyd Perry Snyder 1980 132 p
Avail: Univ. Microfilms Order No. 8107472

Observations of dawn/dusk transition fading of very low frequency radiowaves on a long, transequatorial northeasterly propagation path are reported. A mode conversion model is developed and numerical modeling results are presented for transition fading on long transequatorial paths, both northeasterly and southwesterly. Significant results and conclusions are discussed. Dissert. Abstr.

N81-22255 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN INTEGRAL EQUATION PROCEDURE FOR EDDY CURRENT PROBLEMS Ph.D. Thesis
Subramaniya Iyer Hariharan 1980 84 p
Avail: Univ. Microfilms Order No. 8107881

Scattering of electromagnetic fields by metallic obstacles lead to eddy current problems. For two dimensional geometries the eddy current problem is reduced to an interface problem. In physical situations there are two kinds of approximations. They are letting beta tend to zero and alpha tend to infinity respectively. An integral equation procedure is presented for general alpha and beta. Existence and uniqueness theorems are established and a numerical procedure is described. Results of numerical experiments are reported validating the procedure. An asymptotic procedure for large alpha is presented. Also a scheme for numerical implementation of this procedure is described and the results of the corresponding numerical experiments are reported. It is proved that the solution for beta 0 tends to that for beta 0 as beta yields 0. Dissert. Abstr.

N81-22256 Tennessee Univ., Knoxville.
BOUNDS, SAMPLING, AND AMPLITUDE UNCERTAINTY OF BAND-LIMITED FUNCTIONS Ph.D. Thesis
Richard Eugene Woods, Jr. 1980 128 p
Avail: Univ. Microfilms Order No. 8108180

A comprehensive analysis of the average rate of change of band limited functions is presented, including a derivation of the least upper bound on functions for which either the zeroth absolute moments (spectral areas) or Fourier amplitude spectra of the functions are bounded. These results are extended to the case of functions that are limited in both frequency and amplitude. The average rate of change of a function over an interval in which one end point of the interval is an extremum of the function is similarly bounded and used to establish a sampling rate which guarantees that, between successive samples of a band limited function, the function itself does not deviate from either sample by more than predefined amplitude change. Based on these results, several problems of practical importance, including slope overload error in delta modulation, aperture time and amplitude uncertainty in analog to digital conversion, the estimation of level crossing statistics, and the detection and elimination of high frequency pulses from a low frequency signal, are examined. Dissert. Abstr.

N81-22257 Fondazione Ugo Bordoni, Rome (Italy).
SYMMETRICAL ALTERNATE ROUTING FOR ENHANCING TELEPHONE NETWORK RESILIENCE
Davide Grillo and Fabrizio Panaioli (Fatme, Rome) Jun. 1980 8 p refs Presented at Symp. on Telecommun. Network Planning, Paris, 29 Sep. - 2 Oct. 1980
(FUB-17-1980) Avail: NTIS HC A02

The effectiveness of a routing discipline based on restricted symmetrical overflow is investigated for accomodating abnormal traffic situations in full mesh networks. The restriction consists in inhibiting overflow traffic from accessing trunk groups when these are in a state of predeterminated occupancy. In addition, alternate paths are allowed when conveying on only one tandem center. The method was tested studying the network behavior in a number of typical impaired situations. It is shown that the tested algorithm meets the requirement of maintaining high call carrying capacity. Author (ESA)

N81-22258*# National Aeronautics and Space Administration, Washington, D. C.
SCATTER OF X-RAYS ON POLISHED SURFACES
G. Hasinger Jan. 1981 58 p refs Transl. into ENGLISH of "Die Streuung von Roentgenstrahlen an Polierten Oberflaechen" rept. MPI-PAE/Extraterr-163 Garching, West Germany, May 1980 65 p Translation also announced as N81-19901 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Max Planck Inst. fuer Physik und Astrophysik, Garching, West Germany
(Contract NASw-3198)
(NASA-TM-76443; MPI-PAE/Extraterr-163) Avail: NTIS HC A04/MF A01 CSCL 20N

In investigating the dispersion properties of telescope mirrors used in X-ray astronomy, the slight scattering characteristics of X-ray radiation by statistically rough surfaces were examined. The mathematics and geometry of scattering theory are described. The measurement test assembly is described and results of measurements on samples of plane mirrors are given. Measurement results are evaluated. The direct beam, the convolution of the direct beam and the scattering halo, curve fitting by the method of least squares, various autocorrelation functions, results of the fitting procedure for small scattering, and deviations in the kernel of the scattering distribution are presented. A procedure for quality testing of mirror systems through diagnosis of rough surfaces is described. J.D.H.

N81-22259# Rutgers - The State Univ., Piscataway, N. J. Dept. of Electrical Engineering.
MATHEMATICAL MODELING OF MULTI-ELEMENT MONO-

POLE ANTENNAS Final Report
N. N. Puri, G. Goubau, A. Stavridis, and S. Fich 9 Mar. 1981 123 p
(Contract DAAG29-79-C-0201; Grant DAAG29-77-G-0228)
(AD-A096685; ARO-15415.2-EL) Avail: NTIS HC A06/MF A01 CSCL 09/5

This research document presents a new theory for the analysis of multi-element antennas which consists of interconnected conductive structure elements of electrically small dimensions. The theory is based on the retarded electromagnet potentials which permit a diakoptic approach to the problem. The antenna is broken up into its individual structure elements. Each element is assumed to be excited, (a) by currents which are impressed at its terminals, i.e., junctions with adjacent elements (current coupling), and (b) by the electric fields of the currents and charges on all the other elements (field coupling). Both excitations are treated independently. Each impressed current produces a 'dominant' current distribution, a characteristic of the element, which can be readily computed. Current coupling is formulated by 'intrinsic' impedance matrices which relate the scalar potentials at the terminals of an element, caused by its dominant current distributions, to the impressed currents of the element. Field coupling produces 'scatter' currents on all the elements, and is formulated by a 'field coupling' matrix which relates the scalar potentials at the terminals, caused by field coupling, to the impressed currents at all the terminals. Intrinsic and 'field coupling' are combined to form the 'complete' impedance matrix of the diakopted antenna. Enforcing continuity of the currents and equality of the scalar potentials at all the interconnections between the elements yields a system of linear equations for the junction currents and the input impedance of the antenna. Current coupling dominates over field coupling. Field coupling due to the dominant current distributions of the elements is of primary importance while field coupling due to the scatter currents is, in general, negligible. GRA

N81-22260# Office of Naval Research, London (England).
REPORT ON THE INTERNATIONAL CONFERENCE ON RADIO SPECTRUM CONSERVATION TECHNIQUES
George M. Sokol 31 Dec. 1980 8 p Conf. held in London, 7-9 Jul. 1980
(AD-A096675; ONRL-C-11-80) Avail: NTIS HC A02/MF A01 CSCL 17/2

This is a review of the highlights of a conference reviewing the results of recent research in developing improved techniques for reducing the requirements for band width in communications. Bandwidth-efficient interference resistant modulation, frequency re-use, cellular organization of short range transmitters, and satellite systems are among the techniques discussed. Areas of interest include mobile radio, broadcasting telephone systems, satellite systems, and spectrum planning, assignment and measurement. GRA

N81-22261# Applied Science Associates, Inc., Apex, N. C.
A STUDY OF TERRAIN SCATTERING PHYSICS Final Technical Report, 8 Sep. 1978 - 30 Sep. 1980
Gary S. Brown Griffiss AFB, N.Y. RADC Feb. 1981 118 p refs
(Contract F19628-78-C-0211; AF Proj. 2305)
(AD-A097020; ASA-80-(AF)-1; RADC-TR-80-369) Avail: NTIS HC A06/MF A01 CSCL 17/9

This report presents results of a study to improve existing models for scattering from rough terrain. The two-scale composite surface model is first corrected to properly account for shadowing. This correction shows that both the optical and Bragg scattering terms in the expression for sigma degree go to zero as grazing incidence is approached. The shadowing function for non-Gaussian surfaces is shown to be easily obtained from existing theories and numerical results for exponentially distributed surfaces are presented. The two-scale composite surface based upon the Burrows perturbation theory is extended to the following cases: bistatic scattering from a dielectric surface with small scale roughness, and bistatic scattering from a dielectric surface with large and small scales of roughness. Comparisons are made with the Rice theory for both cases. It is shown how an existing theoretical relationship between the height and slope probability density functions can be used to practically obtain one from the other. Finally, a new integral equation is developed for the coherent field scattered from a perfectly conducting rough surface. Asymptotic evaluation of this equation in the limit of large Rayleigh parameter indicates that surface slopes cannot be ignored. GRA

N81-22262# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
FREQUENCY-DOMAIN UPPER BOUNDS FOR SIGNALS ON A MULTICONDUCTOR TRANSMISSION LINE BEHIND AN APERTURE Annual Report
William A. Davis and Mohammad K. Sistanizadeh 25 Feb. 1981 17 p refs Submitted for publication
(Grant AF-AFOSR-0138-80)
(AD-A096967; AFOSR-81-0281TR) Avail: NTIS HC A02/MF A01 CSCL 20/14

This paper develops a technique for bounding the maximum voltages and currents at terminations of a multiconductor transmission line (MTL) located behind an aperture-perforated conducting screen excited by an electromagnetic field in the frequency domain. The electromagnetic field is coupled through a small aperture as the excitation of a multiconductor transmission line behind the aperture. A model is presented in terms of external and internal sources which in turn create traveling waves on the multiconductor transmission line. These traveling waves transfer energy to the terminations. The energy at a termination is translated into voltages and currents from which the upper bounds are determined. These upper bounds are obtained using vector norms and associated matrix norms. The formulation is presented in the frequency domain to obtain useful upper bounds for analysis of multiconductor transmission line geometries with aperture excitation. GRA

N81-22263# Naval Ocean Systems Center, San Diego, Calif.
NUMERICAL ELECTROMAGNETICS CODE (NEC)-METHOD OF MOMENTS: A USER ORIENTED COMPUTER CODE FOR ANALYSIS OF THE ELECTROMAGNETIC RESPONSE OF ANTENNAS AND OTHER METAL STRUCTURES. PART 1: PROGRAM DESCRIPTION THEORY. PART 2: PROGRAM DESCRIPTION CODE. PART 3: USER'S GUIDE. REVISION
G. J. Burke (California Univ., Lawrence Livermore Lab.) and A. J. Pogio (California Univ., Lawrence Livermore Lab.) Jan. 1981 455 p refs
(AD-A096982; NOSC/TD-116-Rev) Avail: NTIS HC A20/MF A01 CSCL 20/14

The Numerical Electromagnetics Code (NEC-2) is a computer code for analyzing the electromagnetic response of an arbitrary structure consisting of wires and surfaces in free space or over a ground plane. The analysis is accomplished by the numerical solution of integral equations for induced currents. The solution includes a Numerical Green's Function for partitioned-matrix solution and a treatment for lossy grounds that is accurate for antennas very close to the ground surface. The excitation may be an incident plane wave or a voltage source on a wire, while the output may include current and charge density, electric or magnetic field in the vicinity of the structure, and radiated fields. Other options compute the maximum coupling between antennas and facilitate structure input. Hence the code may be used for antenna analysis, EMP, or scattering studies. Part 1 of the document includes the equations on which the code is based and a discussion of the approximations and numerical methods used in the numerical solution. Some comparisons to demonstrate the range of accuracy of approximations are also included. Details of the coding and a User's Guide are provided as parts 2 and 3, respectively. GRA

N81-22264# Naval Research Lab., Washington, D. C.
MULTIFOCAL THREE DIMENSIONAL BOOTLACE LENSES Final Report
Jaganmohan B. L. Rao 12 Mar. 1981 28 p refs
(AD-A096505; NRL-8465) Avail: NTIS HC A03/MF A01 CSCL 09/5

It is well known that a two dimensional (parallel plate configuration) bootlace lens can be designed to have more than one focal point. Wide angle scanning capabilities of these lenses in two dimensions is well established, being larger for higher numbers of focal points. However, no three dimensional bootlace lens having more than one focal point has been reported. It is the purpose here to report on three dimensional bootlace lenses

having two, three, and four perfect focal points. Equations for lens surfaces are obtained for all three cases. An analysis shows that a lens with a larger number of focal points can be scanned to much larger angles in one plane at the expense of a modest decrease in scanning capability in the orthogonal plane. Computer simulations of radiation patterns for different scan angles are presented for all three lenses. These results also show that a lens with a higher number of focal points can be scanned to larger angles. GRA

N81-22265# Pacific Missile Test Center, Point Mugu, Calif.
TECHNIQUES FOR MICROWAVE IMAGING
D. L. Mensa 18 Jan. 1981 171 p refs
(AD-A096863; PMTC-TP-81-08) Avail: NTIS HC A08/MF A01 CSCL 17/9

A number of techniques for obtaining high resolution microwave images are presented. A system for obtaining two dimensional images is described which combines pulse compression and synthetic aperture processing of signals reflected from rotating objects to achieve resolution in range and cross range. Both the pulse compression and synthetic aperture processing are accomplished by discrete Fourier transforms (DFTs) implemented by fast Fourier transform (FFT) algorithms. Examples of images are presented which demonstrate resolution of three wavelengths using a signal bandwidth of approximately 1.5 GHz and an object rotation of 10 degrees. The principal limitation of this technique is the image degradation which results from focal aberrations in the unfocused synthesized aperture. Focusing the synethic aperture leads to a point spread function which is diffraction limited and space invariant. The required focusing operation is implemented by mapping the recorded signals through a polar transformation and subsequently processing the data with a two dimensional Fourier transform. GRA

N81-22266# Ohio State Univ., Columbus. Electroscience Lab.
GTD ANALYSIS OF A STRIP SCATTERER IN THE NEAR FIELD OF AN ANTENNA
Yueh-Chi Chang Dec. 1980 103 p refs
(Contract N62269-80-C-0384)
(AD-A096600; ESL-713303-1) Avail: NTIS HC A06/MF A01 CSCL 20/14

Various computer codes have been developed by using Geometrical Theory of Diffraction (GTD) to calculate the scattering effects associated with antennas in the presence of scattering structures. These codes are most useful for low gain antennas although they can simulate large antennas using the superposition principle. Unfortunately, this approach results in large computer run times for antennas that have to be subdivided into many smaller elements. Two approaches for overcoming this limitation in two dimensional cases are investigated in this thesis: (a) the large subaperture technique and (b) the two-point GTD source field method. Both approaches use the GTD method to calculate the scattering from structures in a similar way to that used in the present codes. However, the fields of the antennas or sources are treated in ways to permit more efficient calculations in these approaches. Both approaches have turned out to be useful and complement each other. GRA

N81-22267# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
DESIGN STUDY FOR A COHERENT POLARIZATION-DIVERSITY RADAR Final Report, 1 Mar. 1979 - 11 Apr. 1980
James I. Metcalf, William A. Holm, Donald G. Bodnar, Edward E. Martin, and Robert N. Trebits 30 Apr. 1980 95 p refs
(Contract F19628-79-C-0076; AF Proj. 6670)
(AD-A096757; AFGL-TR-80-0262) Avail: NTIS HC A05/MF A01 CSCL 17/9

Design concepts for a coherent polarization-diversity radar are presented. The desired capability is the measurement of microphysical parameters of hydrometeors, including thermodynamic phase, shape, size, orientation, and number density. The postulated use of a polarization-diversity radar is based on the relationships of these parameters to the anisotropy of the scattering and propagation media. The measurement objectives lead to the specification of primary and secondary coverage regions. Target detection within the primary region (less than 40 km range) and propagation effects lead to the specification of S-band and Ka-band as optimum frequency bands for observations of precipitation and clouds, respectively. Radar system parameters are specified, and schematic diagrams of system hardware are presented. Antenna design concepts and practical considerations are discussed. We discuss concepts of data processing and a pussible computer-oriented implementation of radar control and data processing. GRA

N81-22268# Ball Aerospace Systems Div., Boulder, Colo.
THE 15 GHz MICROSTRIP ARRAY DEVELOPMENT Final Technical Report, 1 Mar. 1979 - 31 May 1980
Ron Stockton and Marguerite M. Balint Griffiss AFB, N.Y. RADC Feb. 1981 82 p refs
(Contracts F30602-79-C-0114; F30602-75-C-0137; AF Proj. 4519)
(AD-A096869; BASD/F80-15; RADC-TR-80-403) Avail: NTIS HC A05/MF A01 CSCL 09/1

An investigation of the feasibility of electronically scannable microstrip phased array antennas operating in the 15 GHz region was accomplished. Monolithic, multi-layer and modular approaches were analyzed and their expected performance capabilities, cost, weight, and other factors were compared. In addition, a prototype model of a preferred array design was fabricated and tested. GRA

N81-22269# General Electric Co., Syracuse, N.Y. Military Electronic Systems Operation.
IONOSPHERIC ELECTRON CONTENT EFFECTS ON EARTH-SPACE RADIO PROPAGATION. A REVIEW
George H. Millman Dec. 1980 36 p refs Presented at the Comm. on Space Res. (COSPAR) Beacon Satellite Group Symp. on Sci. and Eng. Uses of Satellite Radio Beacons, Warsaw, 19-23 May 1980
(AD-A096735; R80EMH11) Avail: NTIS HC A03/MF A01 CSCL 20/14

Radio waves, when traversing the ionosphere, undergo various types of signal degradation due to the nonhomogeneous characteristics of the medium. In this paper, the propagational effects such as group time delay, angular bending, phase and Doppler frequency shift, rotation of the plane of polarization and dispersion resulting from the presence of ionization along Earth-space transmission paths are reviewed. The phenomena are described and assessed in terms of frequencies in the VHF range and above. The various techniques for the measurement of the ionospheric ionization are briefly discussed. GRA

N81-22270# California Univ., Livermore. Lawrence Livermore Lab.
CHARACTERIZATION OF ERRORS INHERENT IN SYSTEM EMP VULNERABILITY ASSESSMENT PROGRAMS
R. M. Bevensee, H. S. Cabayan, F. J. Deadrick, L. C. Martin, and R. W. Mensing 1 Oct. 1980 252 p refs
(Contract W-7405-eng-48)
(AD-A096696; UCRL-52954) Avail: NTIS HC A12/MF A01 CSCL 12/1

The overall objectives of the DNA-funded program at LLL are to provide a measure of accuracy of currently used EMP vulnerability assessment methodology. In addition, system tools are to be provided to improve the confidence in assessment efforts, which in turn will result in improved confidence in establishing hardening requirements. During Phase I, assessment techniques currently used by the EMP community are surveyed and the sources of uncertainty are identified. Typical data are presented for quantifying the major soruces of uncertainty in all phases of the assessment effort. During this phase, a statistical methodology to assess the impact of uncertainty on the survivability of a system has been partially validated with a simple system test. GRA

N81-22271# George Washington Univ., Washington, D.C.
INVESTIGATIONS OF THE STRUCTURE AND ELECTROMAGNETIC INTERACTIONS OF FEW-BODY SYSTEMS Progress Report, 1 Jan. - 1 Oct. 1980
Edmund P. Harper, Donald R. Lehman, and F. Prats 7 Nov. 1980 21 p ref
(Contract DE-AS05-79ER-10332)
(DOE/ER-10332/1) Avail: NTIS HC A02/MF A01

Progress in few-body structure problems (e.g., the existence of isobar components in H-3, predictions of few-body-hypernuclei properties as a test of hyperon-nucleon interactions, investigation of the A = 6 ground states with exact three-body calculations, and the relation of triton D-state properties to the deutron's D-state percentage) and electromagnetic properties and interactions of few-body nuclei (e.g., Coulomb effects in calculating and measuring asymptotic normalization constants, and gamma + He-3 breakup reaction mechanisms at intermediate energies) is reported. Descriptions of the progress made indicate where each subject stands at present, and emphasize the significant results obtained. DOE

N81-22272# AEG-Telefunken, Ulm (West Germany). Grundlagenentwicklung.

THE 4/64 GHz UPPERSIDEBAND UP CONVERTER USED FOR A 60 GHz TRANSPONDER SYSTEM Final Report

Helmut Barth Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 52 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-23; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

As well as the upconverter, a highly stable synchronized 60 GHz oscillator pump was built. The devices were characterized, and active frequency synchronization is discussed. Relevant measured operating characteristics are: signal frequency (3.7 to 4.2 GHz), conversion gain (3 + or - 0.3 dB over 63.7 to 64.2 GHz), AM to PM conversion (0.2 dB/deg), and pump power output (110 mW). An external quality factor of 8400 at the pump source is also reported. Author (ESA)

N81-22273# Siemens A.G., Munich (West Germany).

SATELLITE ANTENNAS IN THE FREQUENCY RANGE AROUND AND ABOVE 30 GHz Final Report

Erwin Haertinger, Werner Jatsch, Horst Kirchhoff, Uwe Leupelt, Dietrich Lovis, Wolfgang Rebham, and Helmut Thiere Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 306 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerim fuer Forschung und Technologie

(BMFT-FB-W-79-37; ISSN-0170-1339) Avail: NTIS HC A14/MF A01

The practicality of directional antennas for communication satellites was investigated. Developmental problems, production considerations, and necessary fine tuning tolerances were identified. Technology assessment results show that the principles of conventional reflector antennas are fundamentally applicable and show good radiation patterns at justifiable expense. A lens antenna is discussed for the 30, 40 and 60 GHz frequency range, specifically in combination with feed arrays. For better coverage illumination a complex reflector and feed design is suggested. Author (ESA)

N81-22274# European Space Agency, Paris (France).

DETERMINATION OF THE FAR-FIELD FROM MEASURED NEAR-FIELD DATA, THEORY AND MEASURING TECHNIQUE OF THE NEAR-FIELD FAR-FIELD TRANSFORMATION

Arno Schrott and Volker Stein Dec. 1980 100 p refs Transl. into ENGLISH of 'Bestimmung des Fernfelds aus Nahfeldmessdaten Theorie u. Messtech. der Nahfeld-Fernfeldtransformation", Rept. DFVLR-Mitt-79-07 DFVLR, Oberpfaffenhofen, West Germany, Apr. 1979 Original report in GERMAN previously announced as N80-22577

(ESA-TT-616; DFVLR-Mitt-79-07) Avail: NTIS HC A05/MF A01

Methods are described for measuring the far field of antennas at distances that are small compared to the wavelength of the field. The so called compact test range is explained and the principle of the near field far field transformation is described. The advantages and disadvantages of the planar, cylindrical, and spherical transformation techniques are discussed. Theory and measuring technique for the spherical method are treated extensively. An assessment of the influence of errors is given and the acceptable tolerances are presented. A proposal is given for the construction of a near field test range. Finally the performance of the method is demonstrated with the aid of some examples. Author (ESA)

N81-22275# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

THE INFLUENCE OF THE ATMOSPHERE ON RADIOMETRIC MEASUREMENTS IN THE FREQUENCY RANGE OF 10 GHz TO 400 GHz

Juergen Preissner Sep. 1980 55 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-706)

(DFVLR-Mitt-80-16) Avail: NTIS HC A05/MF A01

The influence of the atmosphere on the brightness temperature of ground based objects, the reflectivities of which are known is discussed. Attenuation caused by atmospheric gases and hydrometeors (rain, fog, clouds, snow) is described in detail. Given this attenuation, a computer program for the radiometric transfer equation was compiled. The possibility of determining the brightness temperature for any object on the ground and for any position of the sensor is shown. The brightness temperature was computed for 38 different frequencies. The results are presented as diagrams. Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-22276 California Univ., Irvine.

RECURSIVE BINARY VALUED IMAGE FILTERS Ph.D. Thesis

Leonard Anthony Ferrari 1980 168 p

Avail: Univ. Microfilms Order No. 8106774

Recursive spatially invariant and spatially varying filter algorithms were developed for image filters with binary valued point spread functions. The nonzero extent of the point spread function is restricted to four connected regions of the image plane which are referred to as digital blobs. Graph theoretic arguments are used to show how to partition a digital blob into minimum number of rectangular subregions. Such a procedure leads to an efficient implementation of a spatially invariant binary valued filter if the cardinality of the partition is sufficiently small. Three recursive algorithms are presented for computing the output of binary valued spatially varying image filters. The first is based on the principle of inclusion and exclusion and also leads to an efficient algorithm for binary valued spatially invariant image filters. The second and third algorithms restrict the nonzero extent of the filter point spread functions to coordinates. Procedures are given for the decomposition of an arbitrary point spread function into a linear sum of binary valued filter functions. Dissert. Abstr.

N81-22277 Wayne State Univ., Detroit, Mich.

PARALLEL PROCESSING: THE INTERCONNECTION PROBLEM Ph.D. Thesis

Mohammad Ali Anwar Abidi 1980 141 p

Avail: Univ. Microfilms Order No. 8107191

A broad class of multistage interconnection networks (entitled GEMINE) included all the existing multistage interconnection networks utilizing Log2N stages of 2 X 2 switching elements. Necessary and sufficient conditions on the connection matrices, such that GEMINE can connect any arbitrary input to any arbitrary output, are derived. Schemes are described for constructing a GEMINE with particular attention to establishment of useful conflict-free, input-output families of bijections. Routing control patterns are derived directly as a linear function of source and destination tags. Necessary and sufficient conditions on an arbitrary permutation, such that GEMINE is conflict-free, are derived. Among the non-conflict-free permutations a class of permutations was identified in which a conflicting permutation can be easily divided into two conflict-free bijections. This class, referred to as two single pass permutations, has simple control patterns. Dissert. Abstr.

N81-22278*# Hughes Aircraft Co., Culver City, Calif. Electro-Optical and Data Systems Group.
FABRICATION AND TESTING OF POLYVINYLIDENE FLUORIDE CAPACITORS
Robert S. Buritz Jun. 1980 115 p refs
(Contract NAS3-21042)
(NASA-CR-159501; FR-80-76-952) Avail: NTIS HC A06/MF A01 CSCL 09A

High energy density capacitors made from metallized polyvinylidene fluoride film were built and tested. Terminations of aluminum-babbitt, tin-babbitt, and all-babbitt were evaluated. All-babbit terminations appeared to be better. The 0.1 microfarad and 2 microfarad capacitors were made of 6 micrometer material. Capacitance, dissipation factor, and insulation resistance measurements were made over the ranges -55 C to 125 C and 10 Hz to 100 kHz. Twelve of forty-one 0.1 microfarad capacitors survived a 5000 hour dc plus ac life test. Under the same conditions, the 2 microfarad capacitors exhibited overheating because of excessive power loss. Some failures occurred after low temperature exposures for 48 hours. No failures were caused by vibration or temperature cycling. J.M.S.

N81-22279*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LINEAR MAGNETIC BEARING Patent Application
Philip A. Studer, inventor (to NASA) Filed 8 Dec. 1980 30 p
(NASA-Case-GSC-12517-1; US-Patent-Appl-SN-214361) Avail: NTIS HC A03/MF A01 CSCL 09C

A linear magnetic bearing system having electromagnet vernier flux paths in shunt relation with permanent magnets, so that the vernier flux does not traverse the permanent magnet, is described. Novelty is believed to reside in providing a linear magnetic bearing having electromagnet flux paths that bypass high reluctance permanent magnets. Particular novelty is believed to reside in providing a linear magnetic bearing with a pair of axially spaced elements having electromagnets for establishing vernier x and y axis control. The magnetic bearing system has possible use in connection with a long life reciprocating cryogenic refrigerator that may be used on the space shuttle. J.D.H.

N81-22280*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL POWER GENERATING SYSTEM Patent Application
Frank J. Nola, inventor (to NASA) Filed 16 Mar. 1981 10 p
(NASA-Case-MFS-25302-1; US-Patent-Appl-SN-253021) Avail: NTIS HC A02/MF A01 CSCL 09C

An alternating current power generation system adopted to inject power in an already powered power line is discussed. The power generating system solves to adjustably coup an induction motor, as a generator, to an ac power line wherein the motor and power line are connected through a triac. The triac is regulated to normally turn on at a relatively late point in each half cycle of its operation, whereby at less than operating speed, and thus when the induction motor functions as a motor rather than as a generator, power consumption from the line is substantially reduced. The principal application will be for windmill powered generation. NASA

N81-22281*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A MICROPROCESSOR-BASED TABLE LOOKUP APPROACH FOR MAGNETIC BEARING LINEARIZATION
Nelson J. Groom and James B. Miller May 1981 29 p refs
(NASA-TP-1838; L-13969) Avail: NTIS HC A03/MF A01 CSCL 13I

An approach for producing a linear transfer characteristic between force command and force output of a magnetic bearing actuator without flux biasing is presented. The approach is microprocessor based and uses a table lookup to generate drive signals for the magnetic bearing power driver. An experimental test setup used to demonstrate the feasibility of the approach is described, and test results are presented. The test setup contains bearing elements similar to those used in a laboratory model annular momentum control device. Author

N81-22282*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
ANTENNA DESIGN AND DEVELOPMENT FOR THE MICROWAVE SUBSYSTEM EXPERIMENTS FOR THE TERMINAL CONFIGURED VEHICLE PROJECT Final Report, 1 Aug. 1976 - 31 Dec. 1979
Jacob Becher, Norman Cohen, and Jim Rublee Mar. 1981 158 p refs
(Grant NsG-1331)
(NASA-CR-164220; PTR-81-7) Avail: NTIS HC A08/MF A01 CSCL 09C

The feasibility of classifying an airport-terminal area for multipath effects, i.e., fadeout potentials or limits of video resolution, is examined. Established transmission links in terminal areas were modeled for landing approaches and overflight patterns. A computer program to obtain signal strength based on a described flight path was written. The application of this model to evaluate the signal transmission obtained in an actual flight equipped with additional signal strength monitoring equipment is described. The actual and computed received signal are compared, and the feasibility of the computer simulation for predicting signal amplitude fluctuation is evaluated. J.D.H.

N81-22283*# Applied Technology, Sunnyvale, Calif.
EVALUATION OF ADVANCED MICROELECTRONIC FLUXLESS SOLDER-BUMP CONTACTS FOR HYBRID MICROCIRCUITS Final Report
R. P. Mandal Jun. 1976 144 p refs
(Contract NAS8-31496)
(NASA-CR-161732) Avail: NTIS HC A07/MF A01 CSCL 09C

Technology for interconnecting monolithic integrated circuit chips with other components is investigated. The advantages and disadvantages of the current flip-chip approach as compared to other interconnection methods are outlined. A fluxless solder-bump contact technology is evaluated. Multiple solder-bump contacts were formed on silicon integrated circuit chips. The solder-bumps, comprised of a rigid nickel under layer and a compliant solder overlayer, were electroformed onto gold device pads with the aid of thick dry film photomasks. Different solder alloys and the use of conductive epoxy for bonding were explored. Fluxless solder-bump bond quality and reliability were evaluated by measuring the effects of centrifuge, thermal cycling, and high temperature storage on bond visual characteristics, bond electrical continuity, and bond shear tests. The applicability and suitability of this technology for hybrid microelectronic packaging is discussed. J.D.H.

N81-22284# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Technical Products Group.
INSTANT START THYRATRON SWITCH Interim Report, 1 Sep. 1979 - 1 May 1980
Spencer Merz and David Turnquist Jan. 1981 29 p ref
(Contract DAAK20-79-C-0270)
(AD-A096579; DELET-TR-79-0270-1; IR-1; IR-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

Efforts into the development of a megawatt instant-on hydrogen thyratron are underway. The design work has been divided into three major areas: (1) cathode development, (2) envelope design, and (3) reservoir development. Two experimental thyratrons have been fabricated in order to study the cold emission characteristics of a tungsten matrix cathode material. Design work has been completed on a new, light-weight envelope assembly. Finally, efforts into the development of a reservoir system are described. GRA

N81-22285# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
HYBRID MICROCIRCUITS, FABRICATION AND ASSEMBLY, 1980 Research and Development Technical Status Report
Isaac H. Pratt Jan. 1981 28 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A097000; DELET-TR-81-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report discusses materials and techniques now being used for the fabrication and assembly of hybrid microcircuits. Hybrid technology provides the means for assembling all major categories of electronics in relatively small enclosures to fulfill size requirements which cannot be met by more conventional

packaging techniques. Analog and digital circuits as well as microwave modules are made in hybrid form. The design, fabrication and testing of hybrid microcircuits are included along with the present status of thin and thick film components and assembly techniques. GRA

N81-22286# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Aug. - 31 Oct. 1980
Alan J. McLaughlin and Alan L. McWhorter 15 Nov. 1980 22 p refs
(Contract F19628-80-C-0002)
(AD-A097023; ESD-TR-80-223) Avail: NTIS HC A02/MF A01 CSCL 09/5

Contents: Data Systems -- Digital Integrated Circuits, Computer Systems; and Solid State -- Advanced Electronic Technology on Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Analog Device Technology. GRA

N81-22287# Lockheed Missiles and Space Co., Sunnyvale, Calif. Advanced Systems Div.
HIGH CONTRAST CRT FACEPLATE Final Technical Report, 19 Sep. 1979 - 19 Oct. 1980
T. G. Maple, I. D. Liu, and Gerry Cox Fort Monmouth, N.J. Army Electronics Research and Development Command Jan. 1981 117 p refs
(Contract DAAK20-79-C-0282; DA Proj. 1L1-62705-AH-94)
(AD-A096969; LMSC-D767020; DELET-TR-79-0282-F) Avail: NTIS HC A06/MF A01 CSCL 09/1

The objective of this program is the development of a high contrast, two color CRT faceplate employing evaporated thin film phosphors and nonreflective backing, utilizing 1710 glass and also sapphire substrates. Twenty-six faceplates were fabricated using 1710 glass and 19 using sapphire as substrate. Sapphire was found to possess several advantages over 1710 glass. The 2000 C plus melting point allows sulfurization treatment of the phosphor film at the optimum 1050 C temperature without faceplate distortion. Adhesion of the film is excellent. Thermal conductivity of sapphire, two orders of magnitude greater than 1710 glass, provides excellent dissipation of heat produced by an electron beam. GRA

N81-22288# Microwave Associates, Inc., Burlington, Mass.
POSITIVE ANODE MAGNETRONS Final Report, 31 Jul. 1977 - 15 Oct. 1979
George Boles 1 Nov. 1980 47 p
(Contract N00123-77-C-1018)
(AD-A096482) Avail: NTIS HC A03/MF A01 CSCL 09/1

This report describes an effort to establish a cost-effective technology for positive-anode magnetrons used by the Navy. This technology was first applied to reduce the cost of tubes used in commercial weather and marine radar. Commercially available, standard, inexpensive parts and the results of analysis of part cost (tolerances) vs. cost and complexity of fixturing provided the technology base. The tube fabricated during this program were all sub-specification. Some tubes exhibited one or more problems such as excessive spurious output, low efficiency and low output power. The last four tubes made were free of spurious emissions but were low in output power. This program demonstrated that there are techniques available to reduce the fabrication cost of tubes, but the program also showed that the changes could indirectly affect RF performance and could require tube design changes. GRA

N81-22289# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 Nov. 1980 - 31 Jan. 1981
Richard Liebert and Joseph Lalak Feb. 1981 13 p
(AD-A096460) Avail: NTIS HC A02/MF A01 CSCL 14/5

The purpose of this work is to develop an X-Y addressed electrophoretic image display (DPID). At a recent DARPA/PL/ISI meeting it was agreed to increase the size of the display from 350 x 600 to 360 x 640 elements. Glass substrates with the required In2O3 thickness have been obtained commercially; it is now no longer necessary to deposit additional material. Better difinition of the row electrodes has been obtained by using this glass and using ion-beam milling rather than liquid etching. Techniques to identify and repair shorts in the row electrodes have been developed. The number of defects has been reduced by better filtration and proper outgassing of the photoresist. Aluminum spits were eliminated by using electron-beam evaporation rather than evaporation from a tungsten coil. Sputter deposition of ITO has been replaced by the more reproducible evaporation technique. To obtain better electrical contact between the display and the fan-out board, the homogeneous conductive elastomer was replaced with a laminated one. A device free of shorts or opens in the row electrodes and free of shorts between the column electrodes is now being tested. GRA

N81-22290# RCA Labs., Princeton, N. J.
MONOLITHIC GaAs DUAL-GATE FET PHASE SHIFTER Triannual Report, 1 Sep. - 31 Dec. 1980
M. Kumar, R. Menna, S. N. Subbarao, H. Huang, and G. T. Taylor Jan. 1981 15 p
(Contract N00014-79-C-0568)
(AD-A096468; PRRL-81-CR-5; TAR-1) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report describes the progress made during the period 1 Sept. 1980 to 31 Dec. 1980 in the development of a monolithic GaAs dual gate FET phase shifter. The development of a 0 degrees to 360 degrees phase shifter using discrete components is described. The results on the variation of phase shift with bias voltages of the dual gate FETs are presented over 4- to 8-GHz band. The progress made in the development of monolithic 0 to 90 phase shifter is also presented. GRA

N81-22291# Colorado State Univ., Fort Collins.
DYNAMIC MODELING OF PHYSICALLY SMALL AND HIGH-FREQUENCY SEMICONDUCTOR DEVICES Final Report
David K. Ferry 1 Mar. 1981 32 p refs
(Grant DAAG29-78-G-0061)
(AD-A096777; ARO-15435.9-EL) Avail: NTIS HC A03/MF A01 CSCL 20/2

A program of research is reviewed that addressed transport in physically small (submicron-to-ultrasubmicron) and/or high frequency semiconductor devices. In devices of the 0.25 micron characteristic length, significant effects on the device performance arise from the fact that the carriers have characteristic response times on the order of the device transit time. Effects due to temporal (and spatial) memory retardation, finite-non-zero collision duration, intra-collisional field effects, and quantization within the device govern the transport. Additionally, device replication can lead to synergistic system performance. This program of study has investigated the role these effects play through utilization of full two-dimensional device simulations that incorporate the various effects. GRA

N81-22292# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
CHARACTERIZATION OF ION-IMPLANTED SEMICONDUCTORS Final Technical Report, 7 May 1976 - 9 May 1980
James E. Ehret, Y. K. Yeo, K. K. Bajaj, Elward T. Rodine, and Gopal Das Wright-Patterson AFB, Ohio AFWAL Nov. 1980 241 p refs
(Contract F33615-76-C-1166; AF Proj. 2306)
(AD-A096827; SRL-6913; AFWAL-TR-80-1171) Avail: NTIS HC A11/MF A01 CSCL 20/2

The purpose of this program was to investigate the controlled doping of compound semiconductors by means of ion implantation. This effort has encompassed: (1) the study of the physics of the ion-implantation process; (2) characterization of the as-grown, implanted, and annealed specimens; and (3) optimization of specimen preparation, implantation, and post-implantation treatment for the application of these techniques to electron-device fabrication. In the sections that follow, studies of III-V semiconductors will be described in detail. The analysis and characterization of the specimen by means of photoluminescence, electrical measurements, capacitance-voltage profiling, far-infrared absorption, transmission electron microscopy, and transient-capacitance studies will be discussed. Some of the characterization techniques represent new developments in experimental capabilities. The fabrication of the apparatus as well as the experimen-

tal methods used in their application will be treated in detail. GRA

N81-22293# Office of Naval Research, London (England).
SECOND INTERNATIONAL CONFERENCE ON SUPERCONDUCTING INTERFERENCE DEVICES AND THE 3RD WORKSHOP ON BIOMAGNETISM
J. R. Neighbours 6 Nov. 1980 17 p refs Conf. held at Berlin, West Germany, 6-9 May 1980
(AD-A096749; ONRL-C-9-80) Avail: NTIS HC A02/MF A01 CSCL 09/5

Sessions held during the SQUID conference covered such topics as junction physics, junction and circuit noise, fabrication of junctions and circuits, high and low frequency applications, computers and cryoelectronics, cryogenic techniques, and geophysical applications. Titles of ten invited and 62 contributed papers are listed and major findings highlighted. GRA

N81-22294# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Physics and Astronomy.
INTER-SUBBAND OPTICAL ABSORPTION IN AN INVERSION LAYER ON A SEMICONDUCTOR SURFACE IN TILTED MAGNETIC FIELDS Progress Report, 1 Jul. 1980 - 30 Jun. 1981
R. F OConnell 1981 8 p refs
(Contract DE-AS05-79ER-10459)
(DOE/ER-10452/12) Avail: NTIS HC A02/MF A01

Investigations into magneto-optical phenomena in silicon metal oxide semiconductor devices are reported. Conditions necessary for achieving a null Faraday rotation effect and a null ellipticity are examined. The calculation of theta for the Appel-Overhauser model for the surface space charge layer in silicon is presented. Speculations into the resolution of discrepancies between theory and experiment in investigations of tilted magnetic fields are described. J.D.H.

N81-22295# California Univ., Livermore. Lawrence Livermore Lab.
PROPOSED DESIGN MODIFICATIONS AND TECHNICAL SPECIFICATION CHANGES ON GRID VOLTAGE DEGRADATION FOR THE POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 (DOCKET NOS. 50-255 AND 50-301)
Robert L. White Jan. 1981 14 p refs
(Contract W-7405-eng-48)
(UCID-18950) Avail: NTIS HC A02/MF A01

The submittals made by the licensee are compared with the NRC staff positions and the review criteria, and the reviewer's conclusion on the acceptability of the proposed system is presented. DOE

N81-22296# California Univ., Berkeley. Accelerator and Fusion Research Div.
TESTING OF ACCELERATOR DIPOLES IN PRESSURIZED SUPERFLUID HELIUM
W. S. Gilbert, S. Caspi, W. Hassenzahl, G. Lambertson, R. Meuser, J Rechen, R. Schafer, and R. Warren 1980 8 p refs Presented at the 11th Intern. Conf. on High Energy Accelerators, Geneva, 7-11 Jul. 1980
(Contract W-7405-eng-48)
(LBL-10756; CONF-800740-25) Avail: NTIS HC A02/MF A01

Two superconducting accelerator dipole magnets, with different internal construction features, were tested in pressurized superfluid helium as well as in regular pool boiling helium and helium. The coils of one magnet were moderately prestressed, and 4.2K design performance was rapidly achieved in the superfluid. The other magnet had very low coil prestress, reduced helium ventilation, and displayed degraded performance, even in the superfluid helium. DOE

N81-22297# Kusko (Alexander), Inc., Needham Heights, Mass.
EVALUATION OF TRANSIENT VOLTAGE SUPPRESSORS FOR SAVING ELECTRIC ENERGY Final Report
D. N. Saunders and D. Galler Feb. 1981 93 p
(EPRI Proj. 1201-11)
(EPRI-EM-1722) Avail: NTIS HC A05/MF A01

Transient voltage suppressors were introduced in the early 1970's to protect electronic and electrical equipment from voltage transients originating in the electric power supply system. Since their introduction, these suppressors have also been sold to the public as a means for saving electric energy, on the basis that they clean up the transients that would reduce the efficiency of transformers, motors, lamps, and other load devices. Field test data, laboratory test results, and theoretical analyses were examined to determine the validity of the claims that suppressors can save energy. It is found that the field tests comparing energy consumption before and after the installation of suppressors were either poorly controlled and showed no energy saving. It is further shown that no increase in energy consumed by load devices subjected to a shower of transients, and no reduction of energy usage after installation of suppressors at loads operating in typical environments. The theoretical analyses for energy saving, based on the amplification mechanism of the transient energy, were shown to have no validity. DOE

N81-22298# Florida Power Corp., St. Petersburg.
ELECTRIC UTILITY SYSTEM PLANNING STUDIES FOR OTEC POWER INTEGRATION Final Report
30 Nov. 1980 281 p refs
(Contract DE-AC02-79ET-29187)
(DOE/ET-29187/T8) Avail: NTIS HC A13/MF A01

The integration of OTEC into the Florida Power Corporation (FTC) system was evaluated. Existing system planning procedures, assumptions, and corporate financial criteria for planning generating capacity were used without modification. A baseline configuration for an OTEC plant was developed for review with standard planning procedures. The OTEC plant characteristics and costs were incorporated in considerable detail. It was found that with the initial set of conditions, OTEC would not be economically viable. Using the same system planning procedures, a number of adjustments were made to the key study assumptions. It was found that two considerations dominate the analysis: the assumed rate of fuel cost escalation, and the projected capital cost of the OTEC plant. After corporate financial analysis, it was found that even if the cost competitive criterion were to be reached, the plan including OTEC could not be financed by FPC. DOE

N81-22299# Westinghouse Electric Corp., East Pittsburgh, Pa. Advanced Systems Technology Div.
STUDY OF THE EFFECTS OF ACCIDENTALLY RELEASED CARBON/GRAPHITE FIBERS ON ELECTRIC POWER EQUIPMENT Final Report, 5 Jun. 1978 - 5 Jun. 1980
S. F. Mauser, J. W. Bankoske, J. H. Cooper, D. G. Davies, C. H. Eichler, A. R. Hileman, T. E. Mousseau, Jr., and G. B. Rackliffe 5 Jun. 1980 173 p
(Contract DE-AC02-78ET-29193)
(DOE/RA-29193/1) Avail: NTIS HC A08/MF A01

The vulnerability of power systems to accidentally released fibers from a composite burn was assessed. The effect of carbon fibers on individual component failure rates and the effect the change in component failure rates has on the power system reliability are discussed. Testing performed to determine the vulnerability of external insulation to carbon fiber contamination consisted of airborne contamination tests on distribution insulators, limited tests on suspension insulators which are commonly used for transmission class voltages, and various tests to quantify the influence of fiber length, voltage stress, etc. on flashover characteristics. The data obtained and analysis performed show that the change of system reliability due to an accidental release from burned carbon fiber composite is negligible. DOE

N81-22300# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
FLEXURAL TYPE ULTRASONIC LIQUID-IN-LINE DETECTORS WITH MULTIPLEXING ELECTRONICS
T. C. Piper Feb. 1981 19 p ref
(Contract DE-AC07-79ID-01675)
(ENICO-1071) Avail: NTIS HC A02/MF A01

The final design is given for an ultrasonic liquid-in-line sensor which fails-safe by indicating the presence of liquid (the alarm condition) in the event of electrical failures. The sensors, the tone-burst electronics used to drive the sensor, the amplifier and time-gate electronics used to retrieve and process the resultant signal, and the sixteen sensor multiplexing-circuitry are described and illustrated. DOE

N81-22301# Westinghouse Electric Corp., East Pittsburgh, Pa. STG Technical Operations Div.
DETERMINATION OF SYNCHRONOUS MACHINE STABILITY STUDY MODELS Final Report
Feb. 1981 168 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 997-4)
(EPRI-EL-1424-Vol-1) Avail: NTIS HC A08/MF A01

Generator model parameters were determined in order to improve the accuracy of power system dynamic stability simulations. The standstill frequency response test method was used on several large generators to determine the various standard model parameters traditionally used to represent a synchronous machine. Line switching tests were performed on one of the generators. A standard generator model with parameters developed from standstill frequency response tests was utilized in a computer simulation of the line switching test to compare results. The validity check was no more accurate than that obtained when the standard model structure was used with parameters developed from design data. DOE

N81-22302# AEG-Telefunken, Kassel (West Germany). Geschaeftsbereich Energieverteilung.
CIRCUIT-BREAKER ARC PHYSICS: PLASMAPHYSICAL INVESTIGATIONS OF TRANSIENT PHENOMENA IN GAS-BLAST CIRCUIT-BREAKER ARCS Final Report
Eckart vonBonin Bonn Bundesministerium fuer Forschung und Technology Dec. 1979 91 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technology
(BMFT-FB-T-79-114; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

High voltage circuit breaker arcs were investigated in order to set up a computer simulation describing the performance of the breaker under various electrical loads. Inherent parameters were identified, and suitable measuring methods without expensive high power tests were delineated. The parameterization of long term interactions between switching arc, arc chamber, and gas flow were considered. Results indicate that the performance of modern high voltage circuit breakers can be simulated up to currents or 80 kA with sufficient accuracy. Author (ESA)

N81-22303# Bosch (Robert) G.m.b.H., Schwieberdingen (West Germany). Zentralabteilung Verfahrenstechnik.
DEVELOPMENT OF RELIABLE SOLDERING METHODS FOR ELECTRONIC CIRCUITS, INCLUDING INVESTIGATION OF SURFACE REACTIONS DURING SOLDERING Final Report
Horst-Joachim Hartmann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 195 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-0416)
(BMFT-FB-T-79-164; ISSN-0340-7608) Avail: NTIS HC A09/MF A01

Soldering, particularly in electronic circuit fabrication, was investigated. Soldering methodology and parameters are discussed. The soldering of thick film circuits in an oxygen free protective atmosphere and without flux is depicted. The improvement and stabilization of solderability of printed circuits and component leads are shown. Test results on the soldering qualities of thick film conductor pastes are presented. Concurrently, test methods were developed. A quantitative method which determines age damage to soldered connections is given along with a solderability test method and a nondestructive test for soldered connection strength on printed circuits. The extension of soldered connection lifetime by increasing the resistance of solders to thermal fatigue is also considered. Author (ESA)

N81-22304# Siemens A.G., Munich (West Germany). Geschaeftsbereich Weitverkehrssysteme.
DEVELOPMENT OF A 14 SECTION LINEAR PHASE FILTER, CENTERED AT 3908 MHz WITH A USABLE BANDWIDTH OF 72 MHz, USING DUAL-MODE RESONATORS Final Report
Gerhard Pfitzenmaier Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 65 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-22; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

Compact, lightweight, high quality microwave (4 GHz) filters for use in satellites were considered. Specifically, delay flattening within the passband by coupling filter resonant circuits which are not consecutive in the equivalent circuit was studied. Basic measurements of couplings and investigations concerning such filters with four and eight resonant circuits show the existence of theoretically unforeseen coupling between resonant circuits, seriously disturbing the filter characteristic with increasing usable bandwidth. Author (ESA)

N81-22305# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Services.
ON ac LOSSES IN NbTi AND Nb3Al WIRES
M. Asdente, G. Cavalleri, and A. M. Ricca 1980 8 p refs Presented at 8th Intern. Cryogenic Eng. Conf. and Exhibition, Genoa, 3-6 Jun. 1980 Sponsored in cooperation with CNR and Ente Nazl. per l'Energia Elettrica
(CISE-1589) Avail: NTIS HC A02/MF A01

Power losses (ac) in mono and multifilamentary Nb3Al wires with a layered structure and in monofilament NbTi wires were measured by a very sensitive electronic microwattmeter as a function of the effective current I, for temperatures ranging from 4.2 K to T sub C. The power loss P versus current I shows a behavior proportional to Iexp(a). For NbTi there is good agreement with BeanAs model (A = 3) and there is also evidence of a surface current. For Nb3Al, A is 5 at 4.2 K and tends to 3 for T tends to T subc. The multifilamentary Nb3Al wire can carry 200 A at 4.2 K, about three times that of the monofilamentary wire. Author (ESA)

N81-22401*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
A BAPTA EMPLOYING ROTARY TRANSFORMERS, STEPPER MOTORS AND CERAMIC BALL BEARINGS
W. Auer *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 189-203 refs (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N81-22306 Wisconsin Univ. - Madison.
PARTICLE CLUSTERS IN FLOWS OF CONCENTRATED SUSPENSIONS Ph.D. Thesis
Alan Lyman Graham 1980 153 p
Avail: Univ. Microfilms Order No. 8105270

Both the theoretical and experimental aspects of particle interactions in suspensions of uniform, solid, neutrally buoyant spheres in Newtonian liquids were investigated. A cell theory was used to derive the dependence of the zero-shear rate relative viscosity on volume concentration of spheres. An apparatus was constructed to observe particle interactions in suspensions in homogeneous shear flow. It was observed that the spheres translate and rotate in groups or clusters that are continuously created and destroyed. Dissert. Abstr.

N81-22307 Carnegie-Mellon Univ., Pittsburgh, Pa.
TRANSPORTATION MODELS FOR THE OPTIMAL SYNTHESIS OF HEAT EXCHANGER NETWORKS Ph.D. Thesis
Jaime Cerda 1980 260 p
Avail: Univ. Microfilms Order No. 8107874

A mathematical formulation for the network design synthesis problem is proposed. The formation accounts for the problem thermodynamic constraints and its solution space only includes feasible networks with maximum energy recovery. Neither cyclic nor split networks are excluded from its feasible region as long as they are thermodynamically feasible. To evaluate the amount

of utilities demanded by a network with maximum energy recovery, even in the presence of restricted matches, another mathematical model is presented. Another simple mathematical relaxation of the network synthesis problem formulation is defined to help search for all the other feasible networks comprising a minimum number of positive matches. Dissert. Abstr.

N81-22308 Carnegie-Mellon Univ., Pittsburgh, Pa.
ON FLOW THROUGH A POROUS MEDIUM Ph.D. Thesis
Kathleen Anne Pericak-Spector 1980 79 p
Avail: Univ. Microfilms Order No. 8107885

A set of equations describing the flow of an incompressible viscous fluid through a rigid porous medium was studied. Existence, uniqueness, and stability results are established for the case of a region impregnated with fluid, and uniqueness for an unsaturated region. A one dimensional model was also examined. It is shown that under certain initial conditions, smooth solutions fail to exist after a certain finite time. Dissert. Abstr.

N81-22309 Ohio State Univ., Columbus.
A COUPLED PROBLEM OF FINITE DEFORMATION AND FLOW IN POROUS MEDIA Ph.D. Thesis
Atef Bassili Moussa 1980 290 p
Avail: Univ. Microfilms Order No. 8107371

A theory for deformation and two phase flow in porous media was developed. Equations of balance of mass, momentum, moment of momentum and energy for each constituent were postulated. These led to equivalent balance equations for the mixture as a whole to which an entropy production inequality was also postulated. The formulation was then applied to the silage material. A constitutive theory was developed for the mixture. General appropriate constitutive assumptions were suggested and made to satisfy the axiom of material objectivity and entropy production inequality. Material incompressibility was defined and introduced into the general form of constitutive relations. Dissert. Abstr.

N81-22310*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT PIPES CONTAINING ALKALI METAL WORKING FLUID Patent Application
James F. Morris, inventor (to NASA) Filed 16 Mar. 1981 8 p
(NASA-Case-LEW-12253-1; US-Patent-Appl-SN-243682) Avail: NTIS HC A02/MF A01 CSCL 20D

The improvement of high temperature evaporation condensation heat transfer devices which have important and unique advantages in terrestrial and spade energy processing is discussed. The device is in the form of a heat pipe comprising a sealed container or envelope which contains a capillary wick. The temperature of one end of the heat pipe is raised by the input of extremely hot and corrosive heat from an external heat source. A working fluid of a corrosive alkali metal, transfers this heat to a heat receiver remote from the heat source. The container and wick are fabricated from a superalloy containing a small percentage of corrosion inhibiting or gettering element. Lanthanum, scandium, yttrium, thorium, and hafnium are utilized as the alloying metal. NASA

N81-22311*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF A MODIFIED LEADING EDGE ON NOISE AND BOUNDARY-LAYER TRANSITION IN A ROD-WALL SOUND SHIELD AT MACH 5
Theodore R. Creel, Jr., Barbara B. Holley, and Ivan E. Beckwith May 1981 40 p refs
(NASA-TM-81935; L-14196) Avail: NTIS HC A03/MF A01 CSCL 20D

A version of a rod wall sound shield was tested in the Mach 5 pilot quiet tunnel over a range of unit Reynolds numbers from 10 to 35 million per meter. The model was modified by inclining the leading edge plates to produce an initial 2 deg expansion to ascertain the sensitivity of boundary layer transition to leading edge disturbances. Rod surface pitot pressures, mean free stream pitot pressures, and static pressures on the rods and plenum walls were measured. Hot-wire measurements were also made in the model and nozzle free stream at a unit Reynolds number of 15 million per meter. The surface pitot pressures indicated that transition was much farther forward than for the previous tests due to the leading edge modification and minor fabrication flaws in the model. Early boundary layer transition on the rods was confirmed by hot-wire measurements which showed much higher noise levels in the free stream shield flow when compared with results from previous tests. Mean pitot pressure surveys within the shielded region inside the model indicated that there was an overexpansion and recompression that would limit the streamwise length of undisturbed flow to about 13 cm along the centerline. J.M.S.

N81-22312*# Systems and Applied Sciences Corp., Hampton, Va.
INSTABILITY AND TRANSITION IN ROTATING DISK FLOW Final Report
Mujeeb R. Malik Mar. 1981 20 p refs
(Contract NAS1-15604)
(NASA-CR-165689; R-SAL-3/81-01) Avail: NTIS HC A02/MF A01 CSCL 20D

The stability of three dimensional rotating disk flow and the effects of Coriolis forces and streamline curvature were investigated. It was shown that this analysis gives better growth rates than Orr-Sommerfeld equation. Results support the numerical prediction that the number of stationary vortices varies directly with the Reynolds number. E.A.K.

N81-22313*# Martini Engineering, Richland, Wash.
A COMPUTER SIMULATION OF THE TRANSIENT RESPONSE OF A 4 CYLINDER STIRLING ENGINE WITH BURNER AND AIR PREHEATER IN A VEHICLE Final Report
W. R. Martini Mar. 1981 182 p refs
(Contracts DEN3-226; DE-A101-77CS-51040)
(NASA-CR-165262; DOE/NASA/0226-1) Avail: NTIS HC A09/MF A01 CSCL 10B

A series of computer programs are presented with full documentation which simulate the transient behavior of a modern 4 cylinder Siemens arrangement Stirling engine with burner and air preheater. Cold start, cranking, idling, acceleration through 3 gear changes and steady speed operation are simulated. Sample results and complete operating instructions are given. A full source code listing of all programs are included. Author

N81-22314*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEM OF GAS ACCRETION ON A GRAVITATIONAL CENTER
V. A. Ladygin Jun. 1980 14 p refs Transl. into ENGLISH of "K Zadache ob Akkretsii Gaza na Grevitiruyushchiy Tsentr" Rept. Pr-442 Inst. of Space Research, Academy of Sciences (USSR), Moscow, 1978 p 14 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76202) Avail: NTIS HC A02/MF A01 CSCL 20D

A method of the approximated solution of the problem of accretion on a rapidly moving gravitational center is developed. This solution is obtained in the vicinity of the axis of symmetry in the region of the potential flow. The solution of the problem of stationary gas accretion on a moving gravitational center simulates the movement of a substance in interstellar space in the vicinity of a black hole. A detailed picture of gas accretion on a black hole is of interest in connection with the problem of observation of black holes. J.M.S.

N81-22315*# National Aeronautics and Space Administration, Washington, D. C.
THE HYDRODYNAMIC ROLE OF FISH SQUAMOSAL INTEGUMENT AS AN ANALOG OF SURFACES DIRECTLY FORMED BY TURBULENT FLOW. REPORT 1: SIMILARITY BETWEEN IRREGULARITIES IN SQUAMOSAL INTEGUMENT AND THOSE ON SURFACES FORMED BY RIVER BED FLOW
A. F. Kudryashov and V. V. Barsukov Dec. 1980 18 p refs Transl. into ENGLISH from Zoologicheskiy Zh., v. 46 (USSR), no. 3, 1967 p 393-403 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75390) Avail: NTIS HC A02/MF A01 CSCL 20D

The distribution of squamae on the fish body and that of the deposits in the bed of the river can be described by the same equation. The curves reflecting the relative elongation and stability of the body shape of the fish continue the curves showing the elongation of bank spit and stability of the bed of the river.
Author

N81-22316*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF PRESSURE SHOCKS IN THE GALILEO FUEL TRANSFER SYSTEM
Klaus Ebert Feb. 1981 37 p refs Transl. into ENGLISH "Untersuchung von Druckstossen im Fordersystem von Galilio" Rept. RPM-AN1600-0501A, TN-RT33-4/80 Space Div., MBB G.m.b.H., Ottobrun, West Germany, 18 Feb. 1980 36 p Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76543; RPM-AN1600-0501A; TN-RT-33-4/80) Avail: NTIS HC A03/MF A01 CSCL 20D

Pressure shocks caused by valve motions in the Galileo spacecraft fuel transfer system were investigated. The most important fundamental equations were derived and the maximum pressure increases when turning off the 400 or 10 N engines, respectively, were determined. Acceleration of a liquid column by a constant pressure difference, the effects of ignoring friction, a friction solution for laminar flow, and friction for turbulent flow are discussed. The flow speeds obtained from theory give an adequate representation of the experimental values. A.R.H.

N81-22317*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION OF SOLID CARBON RODS IN ZERO AND NORMAL GRAVITY Ph.D. Thesis - Toledo Univ., Ohio
Charles M. Spuckler May 1981 181 p refs
(NASA-TM-81728; E-771) Avail: NTIS HC A09/MF A01 CSCL 21B

In order to investigate the mechanism of carbon combustion and to assess the importance of gravitational induced convection on the process, zero and normal gravity experiments were conducted in which spectroscopic carbon rods were resistance ignitied and burned in dry oxygen environments. In the zero-gravity drop tower tests, a blue flame surrounded the rod, showing that a gas phase reaction in which carbon monoxide was oxidized to carbon dioxide was taking place. The ratio of flame diameter to rod diameter was obtained as a function of time. It was found that this ratio was inversely proportional to both the oxygen pressure and the rod diameter. In the normal gravity tests, direct mass spectrometric sampling was used to measure gas phase concentrations. The gas sampling probe was positioned near the circumference of a horizontally mounted 0.615 cm diameter carbon rod, either at the top or at angles of 45 deg to 90 deg from the top, and yielded concentration profiles of CO2, CO, and O2 as a function of distance from the surface. The mechanicm controlling the combustion process was found to change from chemical process control at the 90 deg and 45 deg probe positions to mass transfer control at the 0 deg probe position at the top of the rod. Under the experimental conditions used, carbon combustion was characterized by two surface reactions, 2C + O2 yields 2CO and CO2 + C yields 2CO, and a gas phase reaction, 2CO + O2 yields 2CO2. J.M.S.

N81-22318# Harry Diamond Labs., Adelphi, Md.
THE DESIGN OF A FLUIDIC COMPLEMENTARY GAIN CHANGER
George Mon Feb. 1981 16 p refs
(DA Proj. 1L1-61102-AH-44)
(AD-A096894; HDL-TM-81-5) Avail: NTIS HC A02/MF A01 CSCL 20/4

A fluidic complementary gain changer without moving parts has been designed and tested. Test results indicate that this gain changer has a pressure gain of about 20 and is capable of having 100% gain at the high-gain extreme and 0% gain at the low-gain extreme. This is a requirement for any gain changer.
GRA

N81-22319# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
A REVIEW OF MARCHING PROCEDURES FOR PARABOLIZED NAVIER-STOKES EQUATIONS Interim Report
S. G. Rubin Feb. 1981 35 p refs Presented at the Symp. on Numerical and Phys. Aspects of Aerodyn. Flows, Long Beach, Calif., 19-21 Jan. 1981
(Contract N00014-78-C-0849; Grant AF-AFOSR-0047-80; NR Proj. 061-258)
(AD-A096623) Avail: NTIS HC A03/MF A01 CSCL 12/1

Marching techniques for the parabolized Navier Stokes equations are considered. With the full pressure interaction and prescribed edge pressure these equations are weakly elliptic in subsonic zones. A minimum marching step size (delta x sub min), proportional to the total thickness of the subsonic layer, exists. However, for thin subsonic boundary layers (Y sub M = 1) and with delta x = O(Y sub M), stable and accurate solutions are possible. With forward differencing of the axial pressure gradient the procedure can be made unconditionally stable; a global iteration procedure, requiring only the storage of the pressure term, has been demonstrated for a separated flow problem. Solutions for incompressible boundary layer-like flows, for internal flows, and for supersonic flow over a cone at incidence with a coupled strongly implicit procedure are presented.
GRA

N81-22320# Wisconsin Univ. - Madison. Mathematics Research Center.
ASYMPTOTIC ANALYSIS OF VON KARMAN FLOWS
Peter A. Markowich Dec. 1980 33 p refs
(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)
(AD-A096643; MRC-TSR-2156) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with asymptotic expansions of solutions of von Karman's swirling flow problem. These expansions are used to prove the convergence of a class of approximative problems, which are set up by substituting the infinite interval on which von Karman's problem is posed, by a finite but large one and by imposing supplementary boundary conditions at the far end. The asymptotic expansions are crucial for the determination of the order of convergence. Exponential convergence is shown for well-posed approximative problems. The given approach is applicable to general nonlinear boundary value problems on infinite intervals, for which the von Karman problem may be considered as a model problem.
GRA

N81-22321# Pennsylvania State Univ., University Park. Applied Research Lab.
THE USE OF DISTRIBUTED ROUGHNESS FOR SCALING CAVITATION INCEPTION
M. L. Billet and J. W. Holl 21 Aug. 1980 24 p refs
(Contract N00024-79-C-6043)
(AD-A096769; ARL/PSU/TM-80-177) Avail: NTIS HC A02/MF A01 CSCL 20/4

Cavitation inception observations on a family of axisymmetric models were made in 1.21 m water tunnel at the Applied Research Laboratory. Inception data were obtained on Schiebe headforms having diameters of 203.2 mm, 50.8 mm and 25.4 mm. The Schiebe headform has a C(pmin) -0.75 and does not experience a separated boundary layer. Initially, cavitation inception data were obtained with no added roughness on the models. Then a distributed roughness of silicon carbide was glued to the nose of the two smaller models and additional cavitation inception data were obtained. Travelling-bubble cavitation was the type of cavitation observed near inception. Results show that it is possible to use a distributed roughness to increase the cavitation inception index to the indices found at higher Reynolds numbers. However the size and location of the roughness are very critical and the basic mechanisms which control this process need further investigation. This paper was presented at the 19th American Towing Tank Conference held in Ann Arbor, Michigan in July 1980.
GRA

N81-22322# Texas Univ. at Arlington. Dept. of Aerospace Engineering and Engineering Mechanics.
THE ANALYSIS OF SECONDARY FLOWS FOR TUBE-LAUNCHED ROCKET CONFIGURATIONS Final Report, 1 Oct. 1979 - 30 Nov. 1980
H. H. Korst (Illinois Univ. at Urbana-Champaign) and John J. Bertin Redstone Arsenal, Ala. Army Missile Command 15 Jan.

1981 50 p refs
(Contract DAAH01-80-C-0118; Grant DAAG29-76-G-0209)
(AD-A096795; Rept-81001; DRSMI/CR-81-3) Avail: NTIS HC A03/MF A01 CSCL 20/4

Theoretical flow-fields have been calculated for various nozzle/launch-tube configurations using this flow model. The solutions, thus calculated, are compared with experimental data in the present paper. The principal objectives of the present paper are (1) to present and engineering model for the impingement flow-field which is produced when an underexpanded supersonic nozzle is exhausted into constant-area tube, (2) to compare the computed flow-field solutions with experimental results, and (3) to use the comparisons to establish the validity of the flow model. GRA

N81-22323# Department of Energy, Idaho Falls, Idaho. Idaho Operations Office.

INVERT 1.0: A PROGRAM FOR SOLVING THE NONLINEAR INVERSE HEAT CONDUCTION PROBLEM FOR ONE DIMENSIONAL SOLIDS

Dale M. Snider EG/G Idaho, Inc. Feb. 1981 78 p refs
(Contract DE-AC07-76ID-01570)
(EGG-2068) Avail: NTIS HC A05/MF A01

The INVERT 1.0 is a digital computer program written in FORTRAN 4 which calculates the surface heat flux of a one dimensional solid using an interior measured temperature and a physical description of the solid. By using two interior measured temperatures, INVERT 1.0 can provide a solution for the heat flux at two surfaces, the heat flux at a boundary and the time dependent power, or the heat flux at a boundary and the time varying thermal conductivity of a material composing the solid. The analytical solution to the inversion problem is described for the one dimensional cylinder, and sample rectangular slab. The program structure, input instructions, and sample problems demonstrating the accuracy of the solution technique are included. DOE

N81-22324# Delft Hydraulics Lab. (Netherlands). Locks, Weirs and Sluices Branch.

DEVELOPMENT OF VIBRATION-FREE GATE DESIGN: LEARNING FROM EXPERIENCE AND THEORY

P. A. Kolkman Nov. 1979 37 p refs Presented at Symp. on Practical Experiences with Flow-Induced Vibrations, Karlsruhe, West Germany, 3-6 Sep. 1979
(Publ-219) Avail: NTIS HC A03/MF A01

Three types of watergate vibration modes (with flow gap width variations due to gate vibration, with constant flow-gap width often accompanied by high-frequency plate vibrations, effects occurring at gate positions where the flow wavers between reattachment and full separation, are reviewed. Design criteria for optimum operation are deduced: stop logs must be carefully designed, flow separation and/or reattachment zones should be prevented; suction forces (generally tending to close the gap) should be avoided for vibration modes with gap size fluctuations; low pressure zones should be vented by admitting air or water from a high pressure region; leak gap widths should be at least 1.5 times the gate edge width; and slender stop logs and gates should be designed so that static and dynamic loads do not prevail over weight. In addition, the resonant frequencies of the gate hoist system should be well above dominant excitation frequencies, and unstable water surfaces should not hit structural surfaces. Author (ESA)

N81-22325# Delft Hydraulics Lab. (Netherlands). Locks, Weirs and Sluices Branch.

EXCITATION AND VIBRATION OF A GRID GATE

R. J. deJong and J. W. G. vanNunen (German-Dutch Wind Tunnel) Nov. 1979 9 p refs Presented at Symp. on Practical Experiences with Flow-Induced Vibrations, Karlsruhe, West Germany, Sep. 1979 Sponsored by State Public Works, Delta Works, The Hague
(Publ-220) Avail: NTIS HC A02/MF A01

The response of a grid gate to static and dynamic loads was investigated, emphasis being given to the effects of streamline and turbulent flows. The grid gate is an alternative solution to parallel surge barrier studies for the Schaldt area in the Netherlands. It exhibits an optimum flow distribution; a short stroke is required for the lifting system. Different scale models were investigated in water and wind tunnels. The strong vibrations observed when the gate was open, which are clearly reinforced by coupling effects, can be eliminated by optimum design together with vibrations occurring at a 60% opening. The grid gate appears to be a good solution to retain a discharge well distributed over the height of a water course. Author (ESA)

N81-22326# Delft Hydraulics Lab. (Netherlands). Locks, Weirs and Sluices Branch.

STABILITY OF VERTICALLY MOVABLE GATES

A. Vrijer Nov. 1979 8 p refs Presented at Symp. on Practical Experiences with Flow-Induced Vibrations, Karlsruhe, West Germany, 3-6 Sep. 1979
(Publ-222) Avail: NTIS HC A02/MF A01

Pressure fluctuations resulting from discharge fluctuations on opening a gate were studied. These pressure fluctuations result in a vertical force on the gate. The experimental models investigated confirm theoretically predicted behavior, i.e., downstream flow separation leads mostly to stable behavior, upstream flow separation leads to mostly unstable behavior. Open gate edges appear to be more stable than massive gate edges. Theoretical predictions with nonlinear effects for positive and negative damping are not, however, completely confirmed with the model. Author (ESA)

N81-22327# Rolls-Royce Ltd., Derby (England).

THE CALCULATION OF QUASI THREE DIMENSIONAL FRICTIONLESS COMPRESSIBLE FLOW IN AXIAL TURBOMACHINES

S. Biniaris 1980 20 p Transl. into ENGLISH from VDI-Berichte, no. 193, 1973
(PNR-90056; Trans-15292; TLT-00808) Avail: NTIS HC A02/MF A01

A method of calculating quasi-three dimensional frictionless flow in axial turbomachines is presented. The flow field is calculated not only in the bladeless spaces but also within the rows of blades. The compressibility, the blade forces and the blade thickness are taken into account. A finite difference method, an extension of earlier work with which initially the quasi-three dimensional flow could only be calculated within a stationary or rotating row of blades, is used. As calculation examples, the flow parameters in the complete field of three axial turbine stages are given. Author (ESA)

N81-22328# Bristol Univ. (England). Dept. of Aeronautical Engineering.

INVESTIGATION OF A THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER WITH SEPARATION IN INCOMPRESSIBLE FLOW B.S. Thesis

A. Alani and C. Mouskis Jun. 1980 65 p refs Original contains color illustrations
(BU-256) Avail: NTIS HC A04/MF A01

Development of a turbulent boundary layer was studied on the floor of an asymmetric diffuser producing lateral pressure gradients, and longitudinal pressure gradients large enough to cause separation. Maximum flow velocity was 29 m per sec with momentum thickness Reynolds number of 20,000 at separation. Pressure distributions, velocity profiles, viscous layer parameters and flow deflections are discussed. A separation front is defined and the flow beyond it is described. The separation occurs further downstream than it does for a two dimensional case with similar streamwise gradients. The results were examined in relation to Colesa Wake hypothesis and a degree of distortion found to be present. Author (ESA)

N81-22329# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Instationaere Aerodynamik.

THE INFLUENCE OF GEOMETRIC PARAMETERS ON THE TRANSFER FUNCTION OF A PRESSURE TUBE WITH SPECIAL CONSIDERATION OF NONLINEARITIES

Karl Kienappel Jul. 1980 69 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-707)
(DFVLR-FB-80-27) Avail: NTIS HC A04/MF A01

The influence of various parameters such as tube length, change of diameter, tube-shape and tube material on the transfer function was investigated experimentally. In many cases there

is a pronouncedly nonlinear behavior. A method is presented to estimate the transfer characteristics for such a nonlinear system. When unsteady pressures are measured on the end of a pressure tube instead of directly at the desired site, the pressure tube changes the unsteady signal. This characteristic is demonstrated to be frequency dependent. Pressure amplitude measurement results are used to determine real values for the transfer function. An empirical model of an estimated pressure control system is given. The possibility of approximating nonlinear pressure transfer from unsteady pressure measurement is shown.
Author (ESA)

N81-22330# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Stroemung und Verbrennung.
INVESTIGATION OF A LAMINAR, TWO COMPONENT BOUNDARY LAYER ALONG AN EVAPORATING LIQUID FILM BY MEANS OF A FINITE DIFFERENCE METHOD
Heinrich Eickhoff, Joerg Schroeppel (Technischen Univ., Berlin), and Frank Thiele (Technischen Univ., Berlin) Sep. 1980 46 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-711)
(DFVLR-FB-80-34) Avail: NTIS HC A04/MF A01

A flat liquid film of constant thickness, at rest, unilaterally wetting a plate is described as it evaporates into a stream of hot air. The two component boundary layer flow which is generated by this system as well as the coupled mass and heat transfer at the liquid film surface is calculated by means of an implicit finite difference method of Hermitian type, taking into account temperature and concentration dependent properties. The solutions of the coupled partial differential equations for mass, momentum, and energy are compared with other investigations with respect to accuracy, required interactions, and grid points. The results underline the precision and the reliability of the numerical method used. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-22331*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LASER VELOCIMETRY TECHNIQUE APPLIED TO THE LANGLEY 0.3 METER TRANSO !IC CRYOGENIC TUNNEL
Luther R. Gartrell, Paul B. Gooderum, William W. Hunter, Jr., and James F. Meyers Apr. 1981 38 p refs
(NASA-TM-81913; L-14244) Avail: NTIS HC A03/MF A01 CSCL 14B

A low power laser velocimeter operating in the forward scatter mode was used to measure free stream mean velocities in the Langley 0.3 Meter Transonic Cryogenic Tunnel. Velocity ranging from 51 to 235 m/s was measured. Measurements were obtained for a variety of nominal tunnel conditions: Mach numbers from 0.20 to 0.77, total temperatures from 100 to 250 K, and pressures from 101 to 152 kPa. Particles were not injected to augment the existing Mie scattering materials. Liquid nitrogen droplets were the existing light scattering material. Liquid nitrogen droplets thermal effects had no detrimental effects on the optical system. E.A.K.

N81-22332*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY FEASIBILITY ANALYSIS OF A PRESSURE MODULATOR RADIOMETER FOR REMOTE SENSING OF TROPOSPHERIC CONSTITUENTS
Harry D. Orr, III and Pamela L. Rarig (Systems and Applied Sciences Corp., Hampton, Va.) Apr. 1981 31 p refs
(NASA-TM-81958; L-14094) Avail: NTIS HC A03/MF A01 CSCL 14B

A pressure modulator radiometer operated in a nadir viewing mode from the top of a midlatitude summer model of the atmosphere was theoretically studied for monitoring the mean volumetric mixing ratio of carbon monoxide in the troposphere. The mechanical characteristics of the instrument on the Nimbus 7 stratospheric and mesospheric sounder experiment are assumed and CO is assumed to be the only infrared active constituent. A line by line radiative transfer computer program is used to simulate the upwelling radiation reaching the top of the atmosphere. The performance of the instrument is examined as a function of the mean pressure in and the length of the instrument gas correlation cell. Instrument sensitivity is described in terms of signal to noise ratio for a 10 percent change in CO mixing ratio. Sensitivity to mixing ratio changes is also studied. It is concluded that tropospheric monitoring requires a pressure modulator drive having a larger swept volume and producing higher compression ratios at higher mean cell pressures than the Nimbus 7 design. Author

N81-22333# Farrand Optical Co., Inc., Valhalla, N.Y.
WIDE ANGLES, COLOR, HOLOGRAPHIC INFINITY OPTICS DISPLAY Final Report
Jose R. Magarinos and Daniel J. Coleman Brooks AFB, Texas Air Force Human Resources Lab. Mar. 1981 97 p refs
(Contract F33615-77-C-0030; AF Proj. 1958)
(AD-A096890; AFHRL-TR-80-53) Avail: NTIS HC A05/MF A01 CSCL 14/5

This project demonstrates the feasibility of producing a holographic compound spherical beamsplitter mirror with full color response. Furthermore, this holographic beamsplitter was incorporated into a Pancake Window display system as a replacement for the classical glass spherical beamsplitter and its performance and color capabilities have been demonstrated. GRA

N81-22334# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
A THERMOPLASTICS ACOUSTICAL HOLOGRAPHY RECORDING DEVICE
D. B. Rivers 25 Sep. 1980 39 p refs
(DA Proj. 1L1-62303-A-214)
(AD-A096477; AD-E950099; DRSMI/RL-81-1-TR) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report documents an attempt to define the various variables which affect thermoplastic when used as a recorder of ultrasound. Various devices using thermoplastic recording media are illustrated. Specific performance data are given. GRA

N81-22335# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
DIGIQUARTZ PRESSURE TRANSDUCER CALIBRATION TEST RESULTS
F. L. Bentzen Dec. 1980 49 p refs
(Contract DE-AC07-79ID-01575)
(ENICO-1073) Avail: NTIS HC A03/MF A01

Calibration of a digiquartz transducer developed to accurate determine the liquid level in chemical fuel reprocessing plants for the purpose of safeguarding the strategic nuclear material is reported. Calibration was accomplished with an automatic data acquisition system using a Hewlett Packard 9825A computer and associated precision laboratory equipment and a Ruska DDR 6000 pressure calibrator. Data were taken from 0 to 15 psid over the range of 15 to 60 C for 14 pressure transducers. DOE

N81-22336# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Physics and Astronomy.
NEW CONCEPT FOR A COMPACT TAPE TRANSPORT SYSTEM
R. L. Mlekodaj (UNISOR, Oak Ridge, Tenn.), E. F. Zganjar, and J. D. Cole 1980 8 p refs
(Contract DE-AS05-76ER-04935)
(ORO-4935-041) Avail: NTIS HC A02/MF A01

A concept in tape transport systems for the collection and counting of radioactive samples from an on line isotope separator was developed. This compact design was motivated by space limitations but important additional improvements over previous designs were made in cost, simplicity, and vacuum quality. The system is based on a continuous loop of 6.5 millimeter wide recording tape 116 meters long with a conducting coating on

one side for beam current monitoring. One small stepping motor is required for operation. DOE

N81-22337# Sigma Research, Inc., Richland, Wash.
DEVELOPMENT OF AN IONIZATION-TYPE GAS DENSITY MONITOR Final Report
E. W. Saaski Dec. 1980 41 p
(EPRI Proj. 1768-1)
(EPRI-EL-1652) Avail: NTIS HC A03/MF A01

A battery operated electronic gas density monitor was developed for SF6 service in gas insulated substation equipment that is based on principles similar to ionization type fire alarms. The monitor has a resolution of 0.1 psia at 68 F and exhibits a linearity of from + or - 0.15 to + or - 0.6 psia at 68 F over the pressure range 30 to 75 psia, depending on ion chamber characteristics and operating voltage. A prototype unit exhibited a deviation from ideality of about 0.01% per degree Fahrenheit over the temperature range -30 F to 105 F and was found insensitive to water vapor in SF6 at levels in excess of 1000 ppM. DOE

N81-22338# Stanford Linear Accelerator Center, Calif.
BEAM ENVELOPE MATCHING FOR BEAM GUIDANCE SYSTEMS
K. L. Brown Aug. 1980 32 p refs Presented at the Conf. on Charged Particle Optics, Giessen, West Germany, 8-12 Sep. 1980
(Contract DE-AC03-76SF-00515)
(SLAC-PUB-2370; CONF-800952-4) Avail: NTIS HC A03/MF A01

Ray optics and phase ellipse optics are developed as tools for designing charged particle beam guidance systems. Specific examples of basic optical systems and of phase ellipse matching are presented as illustrations of these mathematical techniques. DOE

N81-22339# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
SPECKLE PHOTOGRAPHY TECHNIQUES IN WHITE LIGHT [TECNICHE DI FOTOGRAFIA SPECKLE IN LUCE BIANCA]
M. Giglio, S. Musazzi, and U. Perini 1980 11 p refs In ITALIAN Presented at 2nd Natl. Congr. on Quantum and Plasma Electron., Palermo, Italy, 20-22 May 1980
(Contract CNR/CISE-78.02616.11)
(CISE-1648) Avail: NTIS HC A02/MF A01

The application of speckle photography for measuring refraction index gradients is described. The media, with varying refraction index, are interposed between the speckle camera and a plane surface covered by a transparent film embedded with 5 micron reflectant spheres. White light photography depicts variation in light intensity in function of the media refracting index. Convective or turbulent zones are easily recorded. The sensitivity of the method is on the order of 1 millionth cm. Author (ESA)

N81-22340# Techno System Developments, Naples (Italy).
THERMOGRAPHIC SYSTEMS FOR MATERIAL SCIENCE EXPERIMENTS Final Report
Paris ESA Oct. 1980 50 p refs
(Contract ESTEC-4091/79-NL-HP(SC))
(TS-2-80; ESA-CR(P)-1403) Avail: NTIS HC A03/MF A01

Proposed microgravity experiments are reviewed to assess the benefits of thermographic measurement systems, including onboard use on space stations. Typical parameter values are grouped in classes with the specifications required for a thermograph appropriate for the experiment. Active and passive methods for evaluation of temperature and velocity fields are discussed. Active methods involve heating an area of a speciment with a laser, (flying thermal spot and thermal spot footprint methods). Commercially available systems are appraised, and problems involving accuracy, and the requirement for cryogenic cooling are pointed out. Author (ESA)

N81-22393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTI-CHANNEL CHOPPER SYSTEM FOR A TOTAL OZONE MAPPING SPECTROMETER
Arlin J. Krueger and August O. Weilbach (Helvart Associates, Fullerton, Calif.) *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp May 1981 p 63-75 refs (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-22341 Utah Univ., Salt Lake City.
STUDIES OF THE NITROGEN LASER AND NITROGEN PUMPED DYE LASERS Ph.D. Thesis
Wei Edwin Wu 1980 38 p
Avail: Univ. Microfilms Order No. 8101867

The first polarized coherent 337.1 nm radiation with 2 mJ energy per pulse and 1.75 x .5 mrad divergence from the transversely excited atmospheric (TEA) nitrogen laser is presented. The design consists of an oscillator amplifier arrangement with the oscillator coupled to the amplifier by reflection from a quartz plate inclined at Brewster's angle. Using this device as a pumping source, a tunable distributed feedback prism dye laser is demonstrated. Experimental results of the polarization of the superradiance from the dye pumped by the polarized TEA nitrogen laser are also reported. Dissert. Abstr.

N81-22342 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
LASER-INDUCED DAMAGE TO THIN FILM DIELECTRIC COATINGS Ph.D. Thesis
Thomas Wain Walker 1980 134 p
Avail: Univ. Microfilms Order No. 8106926

The laser induced damage thresholds of dielectric thin film coatings were found to be more than an order of magnitude lower than the bulk material damage thresholds. A program was conducted in which thin film damage thresholds were measured as a function of laser wavelength (1.06 micrometers, 0.53 micrometers, 0.35 micrometers and 0.26 micrometers), laser pulse length (5 and 15 nanoseconds), film material and film thickness. The large matrix of data was compared to predictions given by avalanche ionization, multiphoton ionization and impurity theories of laser damage. When Mie absorption cross sections and the exact thermal equations were included into the impurity theory, excellent agreement with the data was found. The avalanche and multiphoton damage theories could not account for most parametric variations in the data. Dissert. Abstr.

N81-22343 California Univ., San Diego.
MODULATION PROPERTIES OF INJECTION LASERS Ph.D. Thesis
Johann Martin Osterwalder 1980 212 p
Avail: Univ. Microfilms Order No. 8107469

A high resolution optical measurement setup consisting of a monochromator and a Fabry Perot interferometer was developed with a resolution capability of 30 Mz in the 0.8 to 0.9 micrometer wavelength range. The measurement setup was used to display the spectra of modulated and unmodulated GaAs heterostructure injection lasers. The unmodulated laser longitudinal and transverse mode behavior was carefully analyzed. It was concluded that no laser transverse modes exist, which is in contrast to earlier reports. All tested lasers from three different manufacturers showed a spectra detail called Fine-structure Ripple (FR). The FR is a periodic ripple that appears on both sides of each longitudinal laser mode, at a frequency spacing of typically 1 to 2.5 GHz. The FR is bias current dependent, and becomes extremely pronounced when lasers are operated in their saturated regions. The pronounced FR of such a hard driven laser is caused by bias current self modulation. Dissert. Abstr.

N81-22344*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODETIC DISTANCE MEASURING APPARATUS Patent Application
James B. Abshire, inventor (to NASA) Filed 19 Dec. 1980 17 p
(NASA-Case-GSC-12609-1; US-Patent-Appl-SN-218586) Avail: NTIS HC A02/MF A01 CSCL 20E

A geodetic distance measuring apparatus which compensates for the refractive index of the atmosphere is discussed. A mode locked laser system with a laser device and its peripheral components is utilized to derive two mutually phase locked optical wavelength signals and one phase locked microwave CW signal which respectively traverse the same distance measurement path. The optical signals are comprised of pulse type signals. Phase comparison of the two optical wavelength pulse signals is used to provide the dry air density while phase comparison of one of the optical wavelength pulse signals and the microwave CW signal issued to provide wet or water vapor density of the air. The distance to be measured corrected for the atmospheric dry air and water vapor densities in the measurement path is computed from these measurements. A time interval unit is included for measuring transit time of individual optical pulses for resolving the phase ambiguity needed with the phase measurements to give the true target distance. NASA

N81-22345# Air Weather Service, Scott AFB, Ill.
ATMOSPHERIC SENSITIVITIES OF HIGH ENERGY LASERS
Thomas H. Pries Sep. 1980 18 p refs
(AD-A096797; AD-E850020; AWS/TN-80/003) Avail: NTIS HC A02/MF A01 CSCL 20/5

The atmosphere affects the propagation of high energy lasers (HEL) by attenuation and defocusing the laser thereby reducing the energy density on a target. This technical note identifies the atmospheric effects on HEL and their significance. GRA

N81-22346# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
INVESTIGATION OF BIAS ERRORS IN LASER DOPPLER VELOCIMETER MEASUREMENTS Interim Technical Report, Jun. 1978 - Jul. 1980
Timothy C. Roesler, Warren H. Stevenson, and H. Doyle Thompson Wright-Patterson AFB, Ohio AFWAL Dec. 1980 88 p refs
(Contract F33615-77-C-2010; AF Proj. 2308)
(AD-A097040; AFWAL-TR-80-2105) Avail: NTIS HC A05/MF A01 CSCL 14/2

The problem of velocity bias Laser Doppler Velocimeter (LDV) measurements made with counter type (burst) signal processors in turbulent flows was investigated. By using a signal processing technique which allowed velocity samples to be taken either randomly or at equal time intervals, the magnitude of the velocity bias was directly measured under various flow conditions. Using this technique, the validity of the one-dimensional velocity weighting correction of McLaughlin an Tiederman was investigated and found to be useful only at turbulence intensities below about 20 percent. Incomplete signal bias was also investigated and found to cause serious errors in unshifted LDV measurements. However, this bias may be virtually eliminated by frequency shifting. GRA

N81-22347# Naval Research Lab., Washington, D. C.
UNIFORMITY OF LASER-DRIVEN, ABLATIVELY ACCELERATED TARGETS
S. P. Obenschain, B. H. Ripin, E. A. McLean, and J. Grun 12 Mar. 1981 15 p refs
(AD-A096566; NRL-MR-4466) Avail: NTIS HC A02/MF A01 CSCL 20/9

A double-target technique is used to measure the uniformity with which laser irradiated thin foil targets are ablatively accelerated. Studies of the effects of laser nonuniformities on the target acceleration reveal an increase in smoothing (symmetrization) with increasing laser intensity. Measurements of targets accelerated to velocities (160 km/sec) sufficient for pellet fusion implosions are presented and discussed. GRA

N81-22348# Army Materials and Mechanics Research Center, Watertown, Mass.
EFFECTS OF CW HIGH INTENSITY LASER IRRADIATION ON CERAMIC COMPOSITE RADOME MATERIALS Final Report
Frederick P. Meyer, Robert Fitzpatrick, and Russell E. Whitcher (Materials Research Labs., Melbourne, Australia) Feb. 1981 16 p refs
(DA Proj. 1L1-62105-AH-84)
(AD-A096775; AMMRC-TR-81-8) Avail: NTIS HC A02/MF A01 CSCL 20/5

Recently developed ceramic composite materials have been subjected to various CW high intensity irradiation and their responses were studied as a function of composition and processing parameters. The addition of high-purity silica, alumino-silicate and alumina fibers to slip-cast fused silica (SCFS) resulted in a moderate increase in flexural strength and elastic modulus but had no effect on the ablation rate. Under CW laser irradiation at 10.6 micrometers and an intensity of 2 kW/square centimeters, the fiber-reinforced fused silica samples failed by meltthrough with their penetration rates all being approximately 0.15 to 0.25 centimeters per second. The damage area around the laser hole was melted into a glassy phase with the fibers completely dissolved. GRA

N81-22349# School of Aerospace Medicine, Brooks AFB, Tex.
PICOSECOND LASER PULSE OPTICAL DENSITY OF THREE 1060-NM FILTERS Interim Report, Sep. 1977 - Jan. 1978
John Taboda Dec. 1980 19 p refs
(AF Proj. 7757)
(AD-A096848; SAM-TR-80-42) Avail: NTIS HC A02/MF A01 CSCL 20/5

Under a U.S. Navy funded research program, three basic types of 1060-nm optical filters were investigated for dynamic response to intense picosecond laser pulses. These included a dyed glass plate (Schott KG-3), a polymethyl methacrylate plate (PMMA) developed for the Air Force for 1060-nm-specific visors, and a dielectric-coated laser cavity mirror manufactured by Korad Corporation. These filters were selected for their high visual transmittance. GRA

N81-22350# Case Western Reserve Univ., Cleveland, Ohio.
POSITIVE ION PHOTODISSOCIATON Final Report, 1 May 1977 - 31 Jul. 1980
Robert C. Dunbar 8 Sep. 1980 73 p refs
(Contract F19628-77-C-0157; AF Proj. 2303)
(AD-A096703; AFGL-TR-80-0270) Avail: NTIS HC A04/MF A01 CSCL 07/5

Photodissociation of a variety of hydrocarbon ions and other ions of atmospheric interest was examined, both to obtain optical-spectroscopic, and also structural information. Techniques for obtaining time and wavelength resolved fluorescence information about ions were applied to several species. Multiphoton photodissociation of polyatomic ions with visible and infrared CW lasers was investigated. GRA

N81-22351# Bendix Corp., Kansas City, Mo.
FABRICATION OF TARGETS TO SUPPORT LASER-DRIVEN SHOCKWAVE EXPERIMENTS Progress Report
J. D. Stein Dec. 1980 23 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2283) Avail: NTIS HC A02/MF A01

The fabrication and characterization of multiple-stepped foils are considered. Physical vapor deposition of metals onto substrates using precise masking to define each step was evaluated. A process for depositing metal onto preetched substrates to replicate precise steps is also discussed. DOE

N81-22352# Sandia Labs., Livermore, Calif.
T-3 ELECTRON-BEAM-EXCITED LASER SYSTEM
R. A. Klein Feb. 1981 47 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2007) Avail: NTIS HC A03/MF A01

A laser system specifically designed to study the kinetics of electron beam driven systems is described. Details of the system are given along with measurements of the electron beam uniformity and deposition in the laser medium. Some HF laser results obtained with this system are also presented. DOE

N81-22353# California Univ., Berkeley. Materials and Molecular Research Div.
NUMERICAL SIMULATION OF TRANSIENT, INCONGRUENT VAPORIZATION INDUCED BY HIGH POWER LASER
C. H. Tsai Jan. 1981 94 p refs
(Contract W-7405-eng-48)
(LBL-12125) Avail: NTIS HC A05/MF A01

A mathematical model and numerical calculations, developed

to solve the heat and mass transfer problems for uranium oxide subject to laser irradiation, can easily be modified for other heat sources or/and other materials. In the uranium-oxygen system, oxygen is the preferentially vaporizing component, and as a result of the finite mobility of oxygen in the solid, an oxygen deficiency is set up near the surface. Because of the bivariant behavior of uranium oxide, the heat transfer problem and the oxygen diffusion problem are coupled and a numerical method of simultaneously solving the two boundary value problems is studied. The temperature dependence of the thermal properties and oxygen diffusivity, as well as the highly ablative effect on the surface, leads to considerable nonlinearities in both the governing differential equations and the boundary conditions. The finite difference method, along with some advanced numerical techniques, is found to be an efficient way to solve this problem. DOE

N81-22354# California Univ., Livermore. Lawrence Livermore Lab.
PERTURBATION THEORY FOR THE VARIABLE PARAMETER FREE ELECTRON LASER
J. C. Garrison and J. Wong 27 Feb. 1981 110 p refs
(Contract W-7405-eng-48)
(UCID-18943) Avail: NTIS HC A06/MF A01

The potential utility of free electron lasers (FEL) for the production of high power tunable radiation stimulated a number of theoretical studies. These may be divided into two groups. The first group consists of computer simulations in which the equations of motion for a large number of electrons are numerically integrated in conjunction with Maxwell's equations for the propagating signal field. The procedure in the second group is analytical. Approximate analytical solutions of the Liouville equation for the electron distribution function are constructed and then used to evaluate the electric current appearing in Maxwell's equations. This gives closed equations for the radiation field which must still be solved numerically. The results of a qualitative study of some of the properties of the one dimensional FEL model are presented using the analytical rather than the computational route. DOE

N81-22355# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
LASER LIGHT DIFFUSION BY MICELLE SOLUTIONS IN THE PROXIMITY OF A PHASE TRANSITION [DIFFUSIONE DI LUCE LASER DA SOLUZIONI MICELLARI IN PROSSIMITA DI UNA TRANSIZIONE DI FASE]
M. Corti and V. Degiorgio 1980 7 p refs In ITALIAN Presented at 2nd Natl. Congr. of Quantum and Plasma Electron., Palermo, Italy, 20-22 May 1980
(Contract CNR/CISE-79.00764.02)
(CISE-1642) Avail: NTIS HC A02/MF A01

The average intensity of diffuse radiation and the intensity autocorrelation function were studied using low intensity (100 mW) Argon laser light passing through macromolecular micelle solutions near the consolute temperature. The micelle aparent molecular weight increase with temperature was sought. The diffuse light intensity, the correlation length and the inverse of the diffusion coefficient at critical concentration were found to diverge with a power law in function of the temperature difference to the critical temperature. The divergence exponents are those of Landau half field theory. Author (ESA)

N81-22356# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
SILANE DISSOCIATION INDUCED BY INFRARED LASER RADIATION [DISSOCIAZIONE DI SILANO INDOTTA DA RADIAZIONE LASER INFRAROSSA]
R. Bilenchi and M. Musci 1980 14 p refs In ITALIAN Presented at 2nd Natl. Congr. on Quantum and Plasma Electron., Palermo, Italy, 20-22 May 1980
(Contract CNR/CISE-78.02616.11)
(CISE-1645) Avail: NTIS HC A02/MF A01

The reaction was studied using a 40 W CW-C02 laser regulated between 918 and 980 cm. A photomultiplier was used to measure visible light, while a PbSnTe fast detector, cooled with liquid nitrogen, was used to analyze infrared luminiscence. Factors governing the separation of solid Si were sought. It is shown that the reaction velocity decreases rapidly with time, even when the residual silane concentation is enough to produce fast initial reaction in a new sample, due to the increase in hydrogen concentration. It is also found that the resonant absorption determines a reduction in the activation energy of the heterogeneous reaction, allowing the deposition of Si at lower temperatures. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-22357 Texas A&M Univ., College Station.
IN-PROCESS TOOL LIFE EVALUATION BY CUTTING FORCE RATIO ANALYSIS Ph.D. Thesis
Narayan Ambaji Kulkarni 1980 153 p
Avail: Univ. Microfilms Order No. 8108022

The relationship between the cutting force ratio, tool wear and cutting conditions was investigated. A central composite design consisting of 2 to the 4th power factorial experiment was used as the statistical design. General linear models and stepwise regression methods were used to develop the postulated first and second order models for the cutting force ratio. Analysis of the results indicates that the force ratio is a function of the cutting tool flank wear. The force ratio, in most of the cases, decreases with the increase of flank wear. The relationship can be represented with acceptable accuracy, either by first or second order equations. During machining of steel, the Hafnium Nitride coated tools have negligible crater wear as compared to the uncoated tools. The type of tool significantly affects the force ratio. Hence, the force ratio models were developed separately for coated and uncoated tools. Dissert. Abstr.

N81-22358*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPARATUS FOR AND METHOD OF COMPENSATING DYNAMIC UNBALANCE Patent Application
John A. Hrastar, Sr., inventor (to NASA) Filed 27 Feb. 1981 29 p
(NASA-Case-GSC-12550-1; US-Patent-Appl-SN-238888) Avail: NTIS HC A03/MF A01 CSCL 13I

An apparatus to stabilize a fine platform that carries a parabolic reflecting dish, utilized in connection with the large aperture, multichannel microwave radiometer, is discussed. It provides compensation for dynamic unbalance imparted to a fixed body by a shaft about which the rotating body rotates. Force components exerted on the fixed body by the rotating body in a plane at right angles to the axis are determined. In response to the determined force components, the rotational speed and effective direction of mass means mounted on the rotating body are controlled. The mass means has an effective axis of rotation in a plane at right angles to the longitudinal axis. NASA

N81-22359*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNIDIRECTIONAL FLEXURAL PIVOT Patent Application
Hossein Bahiman, inventor (to NASA) Filed 16 Mar. 1981 10 p
(NASA-Case-GSC-12622-1; US-Patent-Appl-SN-243684) Avail: NTIS HC A02/MF A01 CSCL 13I

A flexural pivot type bearing is described. A pair of generally coaxial mutually rotatable cylindrical outer ring members are held in spaced apart relationship by three parallelogram shaped relatively thin, flexible, flat planar spring elements which are substantially inextensible in length and are joined to the inside of the outer ring members and held in position by accurate inner ring segments, three for each outer ring member, which respectively span an arc of substantially 120 deg. The parallelogram shape of the spring elements provides a slanted interconnection between the outer ring members. The direction of slant determines in which direction the spring elements can flex or bend unidirectionally to relieve the compression stress imparted thereto by any angular rotation of the outer ring members. Novelty is believed to reside in one or more parallelogram shaped spring elements which are joined to a pair of mutually rotatable

generally cylindrical pivot members at nondiametrically opposing attachment points. J.D.H.

N81-22360*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTIPLE PLATE HYDROSTATIC VISCOUS DAMPER Patent Application
L. P. Ludwig, inventor (to NASA) Filed 27 Feb. 1981 7 p
(NASA-Case-LEW-12445-1; US-Patent-Appl-SN-238887) Avail: NTIS HC A02/MF A01 CSCL 13I

A device for damping radial motion of a rotating shaft is described. The damper comprises a series of spaced plates extending in a radial direction. A hydraulic piston is utilized to place a load in these plates. Each annular plate is provided with a suitable hydrostatic bearing geometry on at least one of its faces. This structure provides a high degree of dampening in a rotor case system of turbomachinery in general. The damper is particularly useful in gas turbine engines. NASA

N81-22361*# National Aeronautics and Space Administration, Washington, D. C.
AN IMPROVED EVALUATION OF SURFACE FINISH WITH A THREE DIMENSIONAL TESTER
Grandadam, Prebet, and Riout Jul. 1980 25 p Transl. into ENGLISH of "Le Rugiosimetre Tridimensionnel pour une Meilleure Evaluation des Etats de Surface" Sudy No. 1.5D.04.0, Final Report no. 6, 20 Jul. 1979 20 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre d'Etude Technique des Industries Mecanique, Senlis, France
(Contract NASw-3199)
(NASA-TM-75835) Avail: NTIS HC A02/MF A01 CSCL 13H

The design and programming of an automated three dimensional surface finish tester is described. The device produces a three dimensional image of the microscopic texture of the examined surface. The surface finish tester presents the following advantages over conventional profilometry: (1) more complete exploration of surface texture by successive probe sweeps; (2) automation of measuring and calculating; (3) more accurate representation of the derived parameters; (4) analysis of the degree of homogeneity of the surface; (5) three dimensional graphic representation accurately depicting the state of the surface; (6) detection of local imperfections; and (7) detection of scoring that occurred during machining. E.A.K.

N81-22362*# National Aeronautics and Space Administration, Washington, D. C.
RELEASABLE CONNECTIONS IN FUEL LINES STUDY TO MINIMIZE THE NUMBER AND RATE OF LEAKS
Biebricher Feb. 1981 33 p Transl. into ENGLISH of "Losbare Verbindugen in Trebstoffleitungen Untersuchung zur Minimierung der Anzahl Bezw. der Leckrate" Rept. RPM-AN1600-02-01A, Issue 1 Space Div., MBB, G.m.b.H. Ottobrun, West Germany, 13 Jun. 1979 31 p Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76545; RPM-AN1600-02-01A) Avail: NTIS HC A03/MF A01 CSCL 13I

A study of just how far the minimization of the B nuts is possible and of which effects on costs and completion date result from this is presented. Research is limited to the B nuts on the 10 N engine, 400 N engine, and field joints above the spin bearing. S.F.

N81-22363# TRW, Inc., Jamestown, N.Y. Bearings Div.
FATIGUE ENDURANCE TESTING OF ION IMPLANTED ROLLER BEARINGS Final Report, Dec. 1978 - Oct. 1980
Harold E. Munson Oct. 1980 54 p refs
(Contract N00014-79-C-0323; WF1401000)
(AD-A096985; TRW-3866) Avail: NTIS HC A04/MF A01 CSCL 13/9

Thirty 40 mm bore roller bearings from a single lot were divided into three groups of ten each. One group received chromium ion implantation, a second group received chromium plus phosphorus ion implantation, and the third group was untreated. The bearings were then subjected to fatigue endurance testing and the resulting data analyzed by use of the Weibull Distribution. No significant differences were found between endurance lives of the three groups. Failure mechanisms appeared identical in all bearings. GRA

N81-22364# Metcut Research Associates, Inc., Cincinnati, Ohio.
REPORT OF THE MACHINABILITY DATA CENTER Final Report, 1 Jan. 1978 - 30 Sep. 1980
John F. Kahles and John L. Krebs Jan. 1981 30 p
(Contract DLA900-77-C-3197)
(AD-A096557; AMMRC-TR-81-2; Rept-14) Avail: NTIS HC A03/MF A01 CSCL 05/2

This is the final report for the operation of the Machinability Data Center by Metcut Research Associates Inc. under government sponsorship. It is the culmination of a highly successful operation wherein all of the established goals have been achieved or exceeded. Cost savings through MDC's operation have been conservatively estimated to be over $220 million from services provided since the Center began operation in 1964. Work was completed on the third edition of the Machining Data Handbook. This third editions is a greatly expanded and technically improved publication designed to meet the information demands of the manufacturing industry. The machining data are presented in both English and metric units to satisfy current U.S. needs. Handbook coverage is expanded from 1,100 to 1,500 materials and from 55 to 89 machining operations, including over 83,000 specific machining recommendations. New or expanded sections cover the nontraditional machining processes, machine chatter and vibration, surface finish and surface integrity, computer aided design and manufacturing, and grinding techniques. This new edition is expected to make a significant contribution toward reducing costs, increasing productivity, and increasing the service reliability of machined components. GRA

N81-22365# Westinghouse Electric Corp., Concordville, Pa. Combustion Turbine Systems Div.
HIGH RELIABILITY GAS TURBINE COMBINED-CYCLE DEVELOPMENT PROGRAM: ADVANCED COMPRESSOR DESIGN STUDY Final Report
Nov. 1980 50 p
(EPRI Proj. 1187-2)
(EPRI-AP-1628) Avail: NTIS HC A03/MF A01

Results of one task of the first phase of the High-Reliability Gas Turbine Combined-Cycle Development Program are presented. The benefits of applying advanced design, low aspect ratio, high throughput compressor technology to heavy duty power generation combustion turbine engines are assessed. The adaptation of this technology to electric utility combustion turbine power plants offers substantial improvements in plant reliability, availability, and maintainability in comparison with units now in service. The development of conceptual designs and performance parameters based on the advanced compressor design approach are included to provide input to the selection of the best compressor configuration to meet the reliability and efficiency goals set forth for the new engine and combined cycle. DOE

N81-22366# Mound Lab., Miamisburg, Ohio.
COMPONENT TEMPERATURE VERSUS LASER WELDING PARAMETERS
William H. Jones 27 Feb. 1981 8 p
(Contract DE-AC04-76DP-00053)
(MLM-2802) Avail: NTIS HC A02/MF A01

A set of laser weld parameters were developed that would produce weld joints of high integrity at low temperatures in applications where component temperature are critically important. Focal distance, pulse rate, welding speed, and beam power were manipulated in varying configurations to produce a leak tight weld joint at low thermal input. DOE

N81-22367# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PORST: A COMPUTER CODE TO ANALYZE THE PERFORMANCE OF RETROFITTED STEAM TURBINES
C. Lee and I. T. Hwang Sep. 1980 34 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV/TM-52) Avail: NTIS HC A03/MF A01

The computer code PORST was developed to analyze the performance of a retrofitted steam turbine that is converted from a single generating to a cogenerating unit for purposes of district heating. Two retrofit schemes are considered: one converts a

condensing turbine to a backpressure unit; the other allows the crossover extraction of steam between turbine cylinders. The code can analyze the performance of a turbine operating at: (1) valve-wide-open condition before retrofit; (2) partial load before retrofit; (3) valve-wide-open after retrofit; and (4) partial load after retrofit. DOE

N81-22368# Westinghouse Electric Corp., Tampa, Fla.
DEVELOPMENT OF AUTOMATED WELDING PROCESS FOR FIELD FABRICATION OF THICK WALLED PRESSURE VESSELS Quarterly Technical Progress Report, period ending 28 Sep. 1980
1980 41 p
(Contracts DE-AC05-78ET-13511; EF-78-C-01-2771)
(DOE/ET-13511/T4; QTPR-4) Avail: NTIS HC A03/MF A01

Progress is reported in research aimed at optimizing an automated welding process for the field fabrication of thick walled pressure vessels and for evaluating the welded joints. Information is included on the welding equipment, mechanical control of the process, joint design, filler wire optimization, in process nondestructive testing of welds, and repair techniques. DOE

N81-22369# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Technology Div.
TECHNIQUE FOR INSERTING CONTROLLED FLAWS HEAVY SECTION WELDMENTS Final Report
E. T. Hughes, T. E. Bahlow, and S. B. Holiwarth Jan. 1981 75 p
(EPRI Proj. 1245-2)
(EPRI-NP-1686) Avail: NTIS HC A04/MF A01

Techniques and procedures were developed to implant fatigue crack flaws of known sizes and orientations in heavy section weldments at desired through wall locations. A procedure for fabricating sealed inserts containing a fatigue crack flaw of known size and orientation was developed and validated. Next, a procedure for implanting such inserts in a heavy section weldment without altering the flaws was developed and validated. Finally, a 280 mm (11 in) thick weldment containing five fatigue crack flaws was fabricated and metallographically sectioned to provide a final validation of the procedures. The mockups is used to obtain quantitative data to evaluate the effectiveness of current ultrasonic testing techniques and techniques such as acoustic imaging and acoustic holography. DOE

N81-22370# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Oct. - Dec. 1980
M. W. Horner Jan. 1981 76 p
(Contract DE-AC01-76ET-10340)
(FE-1806-100) Avail: NTIS HC A05/MF A01

Two full scale, water cooled monolithic, second stage nozzles were successfully tested in a three throat cascade. The nozzles were subjected to full machine operating conditions of pressure, temperature, and mass flow for a total of eight hours and 52 simulated startup/shutdown cycles to full operating conditions. The nozzles completed the testing with no indications of distress and performed as expected which is a significant program achievement. Preparation of two full scale water cooled composite first stage nozzles for testing was also accomplished. The nondestructive evaluation of these nozzles for test readiness revealed that both nozzle segments had indications of small tears in the copper sublayer on the inner endwalls. DOE

N81-22371# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PROTOTYPE NITINOL HEAT ENGINE Final Report
J. L. McNichols, P. C. Brookes, W. S. Ginell, and J. S. Cory Nov. 1980 130 p refs
(Contract DE-AC05-78OR-06028)
(MDC-G9290) Avail: NTIS HC A07/MF A01

A series/parallel nitinol thermoturbine engine was built based upon the principle of, and scaled up in power from, small (less than or equal to 1 watt) single band thermoturbine engines which had previously been built and operated successfully. Equipment and instrumentation were built up for the measurements of the nitinol helix force length temperature (FLT) behavior (state equation). Nitinol 2 mil diameter wire was wound in the form of 1 mm radius helical engine elements. The nitinol elements were characterized and design equations, which relate engine performance to the nitinol FLT properties and to machine dimensions, were used to perform engineering trade offs to optimize performance and to specify engine component sizes, machine dimensions and heat source/sink requirements for optimal performance. A module engine was built with two series cycles and eighty parallel nitinol helical bands. The module was instrumented so that performance could be monitored and diagnostic measurements could be made. The module operated successfully according to the design concept principles. DOE

N81-22372# SIGRI Electrogradhit G.m.b.H., Meitingen (West Germany).
DEVELOPMENT OF HEAVY-DUTY SiC COMPONENTS SPECIALLY FOR VEHICLE GAS TURBINES Final Report
Horst Boeder and Wolfgang Heider Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 61 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-155; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

Given working temperatures in excess of 1000 C, corrosion and oxidation resistance as well as thermoshock resistance requirements are discussed. The improvement of material quality, in particular heat conductance, and of manufacturing technology are described. Prototypes of turbine rotors and rotor blades, combustion chambers, and flame tubes were produced and tested. Promising test results under simulated application conditions are reported. Author (ESA)

N81-22373# Rosenthal-Stemag, Technische Keramik A.G., Selb (West Germany).
DEVELOPMENT OF HEAT RESISTANT NONCORROSIBLE SILICON CARBIDE COMPONENTS FOR GAS TURBINE APPLICATIONS Final Report
Stefan R. Schindler and Axel Krauth Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 83 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-171; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

Ceramic materials for automobile gas turbine engines were developed. Concurrently, suitable forming techniques for the production of nonrotating gas turbine engine parts, using these materials, were sought. Prototypes of combustion chambers, stators and heat exchangers were manufactured and tested. Mechanical characteristics and thermal characteristics for these components are reported. Satisfactory test results under simulated application conditions are shown. Author (ESA)

N81-22374# Prins Maurits Lab. TNO, Rijswijk (Netherlands). Inst. voor Chemische en Technologische Research.
TEST OF THE BLAST VALVE, DIAMETER 300 mm OF THE ADVISORY OFFICE ROYAL ENGINEERS
C. C. J. M. Verspeek 25 Jan. 1979 11 p
(PML-1979-4) Avail: NTIS HC A02/MF A01

The valve is designed to prevent shock waves entering shelters. Incident peak overpressures were measured with a piezoelectric transducer. The correct function of the valve after several shocks with a peak overpressure of 300 kPa was adopted as a criterion. Measurements were made at the moment when the shock wave arrived, when the valve began to move and at the end of the valve motion. Improvements were made to bolts, bolt-springs and the piston rod during the tests. One minor defect occurred (the shifting of the piston over its rod) after 125 shock loads. The valve nevertheless closed and locked properly after the last shock load. Author (ESA)

N81-22375# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
AN INSTRUMENT FOR THE MEASUREMENT OF LONG-TERM VARIATION OF VERTICAL BEARING ALIGNMENTS IN TURBOGENERATORS
A. Clapis, G. L. Lapini, and T. Rossini Sep. 1980 16 p refs Presented at Conf. on Vibration in Rotating Machinery, Cambridge,

Engl., 2-4 Sep. 1980 Sponsored by Ente Nazionale per l'Energia Elettrica
(CISE-1578) Avail: NTIS HC A02/MF A01

The instrument is based on the communicating vessel principle. A number of interconnected cups, containing mercury, are attached to the machine supports. The liquid level variations in the cups, due to their vertical movements, are measured by proximity transducers fixed on the cup tops. Measurements on two large turbogenerators where the alignment changes have caused vibration problems are given. Author (ESA)

N81-22376# Central Electricity Generating Board, Harrogate (England). Engineering Dept.
MAGNETICALLY SEALED EXPLOSION VENT
P. Holdsworth Sep. 1980 3 p
(TDB-356; ISSN-0374-2784) Avail: NTIS HC A02/MF A01

A vent panel for use in a coal pulverizing mill was designed. The lightweight metal panel is held to the body of the mill by a synthetic rubber magnetized strip, which also forms a dust seal. The relieving pressure of the panel can be varied by using strips containing various numbers of magnets. The cost of the reusable panel is one quarter of that of bursting diaphragms. Author (ESA)

N81-22402*# British Aerospace Dynamics Group, Bristol (England).
A MECHANICAL DRIVE FOR RETRACTABLE TELESCOPIC MASTS
M. E. Humphries *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 205-217 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

N81-22404*# Societe Nationale Industrielle Aerospatiale, Cannes (France).
AN ANTENNA FINE POINTING MECHANISM
Bernard Hubert and Pierre Brunet *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 235-252 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

N81-22405*# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
AN ANTENNA POINTING MECHANISM FOR LARGE REFLECTOR ANTENNAS
Hans Heimerdinger *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 253-261 Sponsored in part by DFVLR (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

N81-22406*# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A DRIVE UNIT FOR THE INSTRUMENT POINTING SYSTEM
R. Birner and M. Roth *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 263-278 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

N81-22410*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LATCH MECHANISM FOR THE SPACE TELESCOPE
Hubert F. Schmidt *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 331-339 ref (For primary document see N81-22388 13-39)
(Contract NAS8-32697)
Avail: NTIS HC A19/MF A01 CSCL 13I

N81-22413*# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A CLAMP MECHANISM FOR DEPLOYABLE THREE-TON PAYLOADS
R. Birner and H. Ral *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 375-390 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

N81-22438# Sherbrooke Univ. (Quebec). Dept. of Mechanical Engineering.
IMPEDANCE METHODS FOR MACHINE ANALYSIS
M. Massoud *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 13, No. 3 Mar. 1981 p 17-21 refs (For primary document see N81-22436 13-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington D. C.; $15.00/set CSCL 13/9

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-22377# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Dept. of Statistics.
IMPROVED SUDAKOV-TYPE BOUNDS FOR OPTIMAL CONFIDENCE LIMITS ON THE RELIABILITY OF SERIES SYSTEMS
Bernard Harris and Andrew P. Soms (Wisconsin Univ., Milwaukee) 25 Feb. 1981 8 p refs
(Contracts N00014-79-C-0321; DAAG29-80-C-0041)
(AD-A096889; TR-637) Avail: NTIS HC A02/MF A01 CSCL 05/2

A sharper Sudakov-type lower bound for the lower confidence limit on the reliability of a series system than the one given in Harris and Soms (1980) is obtained. Numerical examples, coverage probabilities and the listings of the short FORTRAN programs used are also provided. GRA

N81-22378# Arinc Research Corp., Annapolis, Md.
RELIABILITY, AVAILABILITY AND MAINTAINABILITY DESIGN PRACTICES GUIDE, VOLUME 1
Robert Hecht Mar. 1981 218 p refs Revised 2 Vol.
(Contract DAAK80-80-C-0781)
(AD-A096896; Rept-1773-01-1-2392-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 05/2

This guide compiles, in one source, selected real-world practices (techniques or tools) available to the Army engineer and manager to improve the reliability, availability, and maintainability (RAM) characteristics of equipment. It is the purpose of this guide to provide a medium for the exchange of experience and knowledge of DARCOM engineers, to minimize re-inventing the wheel, and to provide a single compendium of techniques currently in use and available for adaptation to other systems and equipment. These techniques vary greatly in application, source, and theory. GRA

N81-22379# Arinc Research Corp., Annapolis, Md.
RELIABILITY, AVAILABILITY AND MAINTAINABILITY DESIGN PRACTICES GUIDE, VOLUME 2
Robert Hecht Mar. 1981 170 p Revised 2 Vol.
(Contract DAAK80-80-C-0781)
(AD-A096897; Rept-1773-01-1-2392-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 05/2

This guide compiles, in one source, selected real-world practices(techniques or tools) available to the Army engineer and manager to improve the reliability, availability, and maintainability characteristics of equipment. It is the purpose of this guide to provide a medium for the exchange of experience and knowledge of DARCOM engineers, to minimize 're-inventing the wheel,' and to provide a single compendium of techniques currently in use and available for adaptation to other systems and equipment. These techniques vary greatly in application, source, and theory. GRA

N81-22380# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
METHODS IMPROVEMENT OF THE FLUORESCENT PENETRANT INSPECTION (FPI) PROCESS Final Report, 1 Aug. 1979 - 31 Jul. 1980
J. K. Malpani and J. S. Cargill Wright-Patterson AFB, Ohio AFWAL Oct. 1980 59 p refs
(Contract F33615-79-C-5021; AF Proj. 2418)
(AD-A096484; PWA-FR-13667) Avail: NTIS

HC A04/MF A01 CSCL 07/4

This program investigates key steps and inspection variables to identify those which significantly influence the sensitivity and reliability of Fluorescent Penetrant Inspection (FPI) in an engine maintenance/overhaul facility. The program is composed of two technical phases: (1) surface preparation procedures, and (2) FPI process variables. The program develops surface preparation procedures and optimized FPI process which can lead to improvements of FPI capability without any degradation of structural integrity of engine components. GRA

N81-22381# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

EVALUATION OF MICROENCAPSULATED PENETRANT INSPECTION Final Technical Report, 1 Jun. 1979 - 1 May 1980

J. M. Portaz Wright-Patterson AFB, Ohio AFWAL Dec. 1980 91 p

(Contract F33615-79-C-5042)

(AD-A096826; R80AEG655) Avail: NTIS HC A05/MF A01 CSCL 14/2

Presented are the results of a program to evaluate the merits and short-comings of microencapsulated penetrants for use in fluorescent penetrant inspection to evaluate capsule and spray parameters to effectively use microencapsulated penetrants, and to compare the sensitivity of such a system to a conventional MIL-I-25135 Group VI liquid fluorescent penetrant inspection system. The program was divided into four phases which encompassed selection of materials for encapsulation, evaluation of capsule and spray variables, investigation of removal and developer techniques, measurement of sensitivity, and a process demonstration including environmental and economic analysis. The work culminated with the successful demonstration that microencapsulated penetrants could be applied in such a way to achieve equivalent sensitivity with a MIL-I-25135 Group VI liquid penetrant system. The microencapsulated penetrant system as now developed uses only nonaqueous wet developers which are much more costly than dry or aqueous wet developers. Therefore, the per-part cost of using microencapsulated penetrants is considerably higher than for liquid penetrants where dry or aqueous wet developers are used. GRA

N81-22382# Bendix Corp., Kansas City, Mo.

NONDESTRUCTIVE TESTING OF THERMOCOMPRESSION BONDS Final Report

G. M. Hale Feb. 1981 30 p refs

(Contract DE-AC04-76DP-00613)

(BDX-613-2518) Avail: NTIS HC A03/MF A01

A scanning laser acoustic microscope (SLAM) was used to characterize hybrid microcircuit beam lead bonds formed on thin film networks by a thermocompression process. Results from subsequent pull testing show that the SLAM offered no significant advantage over visual inspection for detecting bad bonds. Infrared microscopy and resistance measurements were also reviewed and rejected as being ineffective inspection methods. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-22383 Wisconsin Univ. - Madison.

DYNAMIC RESPONSE AND STABILITY OF RIGID FRAMES SUBJECTED TO TIME DEPENDENT AXIAL FRAMES Ph.D. Thesis

Chiew Hui Tay 1980 186 p

Avail: Univ. Microfilms Order No. 8028211

A computer program was written to produce continuous ink plots of time-dependent response. Computer programs were also written of each of the methods of determining natural frequency. The effects of constant axial forces on the natural frequencies of three structures were studied. It was found that there is a significant reduction in the natural frequency of a rigid frame where there are axial forces in the members and thus it is not conservative to neglect the effect of axial forces. Dissert. Abstr.

N81-22384 Wyoming Univ., Laramie.

A CLASS OF ORTHOTROPIC PLANE ELASTIC PROBLEMS Ph.D. Thesis

Kuochuang Andy Wang 1980 160 p

Avail: Univ. Microfilms Order No. 8106974

The problem of the orthotropic thin disk subjected to diametrically opposed concentrated forces is treated. In the process of developing the general solution for the strain compatibility equation in terms of an Airy stress function for the two dimensional plane stress problem, a more general stress function in series form was developed. In terms of this stress function various elasticity problems of an orthotropic body are solved. A mathematical model is presented of the orthotropic halfplane subjected to loads applied to its straight line boundary. By the Fourier integral technique, results are obtained for a simple radial distribution. Employing this simple radial distribution, a theory is developed for the disk subjected to diametrically opposed boundary forces. However, for the case of the specially orthotropic body, the compatibility equation is simplified from the complicate ordinary differential equation with variable coefficients to a solvable ordinary differential equation with constrant coefficients. An analytical closed form solution for the specially orthotropic disk is obtained. Dissert. Abstr.

N81-22385 Georgia Inst. of Tech., Atlanta.

AN INVESTIGATION OF THE EFFECT OF THERMAL GRADIENTS ON FRACTURE Ph.D. Thesis

Hui-Ming Yu 1980 139 p

Avail: Univ. Microfilms Order No. 8107291

A description of a model which is developed to examine the thermal effect on fracture was presented. A circular hole with a radial crack, which was subjected to mechanical and thermal loads, was investigated both analytical and experimentally. In the experimental work, the plane strain fracture toughness KIC was used to characterize the material property. A method of measuring temperature was developed to determine the temperature distribution in specimen. The interaction of mechanical and thermal effects was correlated in terms of KIC. In the analytical work, a finite element program was established based upon the variational principle and assumed displacement formulation. A eight-node distorted isoparametric element was used around the crack tip. The values of KI were calculated by the use of the J-integral and the displacement method. Different hole sizes, boundary conditions, and steady and transient state thermal effects for the hole problem cited above were studied. Dissert. Abstr.

N81-22386 Ohio State Univ., Columbus.

LARGE DEFLECTIONS OF CLAMPED RECTANGULAR PLATES WITH ARBITRARY TEMPERATURE DISTRIBUTIONS Ph.D. Thesis

Donald Burchell Paul 1980 256 p

Avail: Univ. Microfilms Order No. 8107379

The governing von Karman large deflection plate equations are modified to account for thermal effects and are solved by a technique which reduces the fourth order nonlinear partial differential equations to a set of cubic algebraic equations. The solution technique utilizes Fourier type series representations of the stress function, lateral deflection and temperature distribution. The modified von Karman compatibility equation is solved by direct substitution. The equilibrium equation is solved through the use of a Galerkin procedure. The combination of these two reduced equations result in an infinite set of simultaneous cubic algebraic equations. These equations allow general planar temperature distributions, mechanical in-plane loading, uniform pressure loading and both symmetric and antisymmetric deformations. Dissert. Abstr.

N81-22387 Pennsylvania Univ., Philadelphia.

FINITE-ELEMENT MODELS BASED ON HIGH ORDER STRUCTURAL THEORIES

David John Barrett 1980 213 p

Avail: Univ. Microfilms Order No. 8107716

A general method for obtaining higher order beam, plate, and shell theories is reviewed and cast in a form suitable for

creating axisymmetric finite element models. Variational principles and Legendre polynomial series expansions are key features in the development. With the intention of examining thick structures, models are produced representing all stress and deformation variables as nonlinear distributions over the thickness coordinate. The high order theory (Hot) elements have curvilinear geometries and a thickness equal to the structure's depth. A transition element model is formed to connect, in the same analysis, the Hot element model and a bilinear finite model. Thick plate and shell structures are analyzed with a model based on a third order theory. The third order theory contains bending theory plus the first symmetric and antisymmetric terms. Thin structures are analyzed through reduced shear integration. The performance of the Hot element models is assessed and the limitations are examined.

Dissert. Abstr.

N81-22388*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE 15TH AEROSPACE MECHANISMS SYMPOSIUM

1981 433 p refs Symp. held in Huntsville, Ala., 14-15 May 1981; sponsored in part by California Inst. of Technology and Lockheed Missiles and Space Co., Inc.

(NASA-CP-2181) Avail: NTIS HC A19/MF A01 CSCL 20K

Technological areas covered include: aerospace propulsion; aerodynamic devices; crew safety; space vehicle control; spacecraft deployment, positioning, and pointing; deployable antennas/reflectors; and large space structures. Devices for payload deployment, payload retention, and crew extravehicular activities on the space shuttle orbiter are also described. For individual titles, see N81-22389 through N81-22415.

N81-22389*# Rockwell International Corp., Downey, Calif. Space Transportation System Development and Production Div.

DRIVE MECHANISM FOR THE SHUTTLE ORBITER/EXTERNAL TANK PROPELLANT DISCONNECT c16

E. Thomas, R. Wilders (Parker Hannifin Corp., Irvine, Calif.), and J. Ulanovsky (Parker Hannifin Corp., Irving, Calif.) *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 1-18 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 22B

The space shuttle design required development of a large, 0.43 m nominal diameter separable disconnect for the liquid hydrogen and liquid oxygen propellant lines at the orbiter to external tank interface. The disconnect provides for shutoff of the propellant flow area by simultaneous action of two rotary flapper valves (orbiter and external tank) prior to disconnect separation. In the case of pneumatic system failure, the rotary flapper valves are closed automatically through mechanical interlocking linkage during disconnect separation. The mechanism must meet requirements while accommodating changes in bearing clearances and linkage geometry over a wide temperature range from ambient to 20.37 K. The mechanical design of the separable disconnect, kinematics of the drive mechanism, and the analysis and test methods used to verify proper operation and qualification for the space shuttle dynamic environments are presented. Author

N81-22390*# Rockwell International Corp., Downey, Calif. Space Transportation System Development and Production Div.

SPACE SHUTTLE ORBITER RUDDER/SPEEDBRAKE ACTUATION SYSTEM c16

Dwight Woolhouse *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 19-29 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 22B

A mechanical hydraulic actuation system for control of the rudder and speedbrake aerosurfaces of the space shuttle orbiter was developed to meet the strict operational requirements imposed on this flight critical function. The requirements, hardware configuration, development experience, and test program accomplished in the evolution of this system are described. E.D.K.

N81-22391*# Ball Aerospace Systems Div., Boulder, Colo.

PAYLOAD RETENTION LATCHES FOR THE SHUTTLE ORBITER c16

Robert D. Renken and Richard P. Maxwell *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 31-46 ref (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 22B

Two latches were designed to mount payloads in the shuttle orbiter bay. Multiple retention latches attach a payload to the sill longerons and another latch device attaches it to the keel. Requirements for each actuator are defined and drive mechanisms are described. Other design aspects discussed include: switch mechanisms, motors, gearboxes, redundancy provisions, structural materials, and lubricants. A preliminary dry lubricant test program is also reviewed and results presented. Author

N81-22392*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

SPACE SHUTTLE SLIDEWIRE EMERGENCY EGRESS SYSTEM c16

Glenn B. Jeffcoat and Emile S. Stephan IN NASA. Marshall Flight Center The 15th Aerospace Mech. Symp. May 1981 p 47-62 refs (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 22B

The slidewire emergency egress system is designed to provide a fast and safe egress means for the shuttle flight crew, passengers, and ground closeout crew in the event of imminent danger while the space vehicle is still on the launch pad. Egress is from the 195 ft. level of the fixed service structure (FSS) to a ground landing area 1200 ft. away from the launch site. The slidewire design is such that the flight crew and passengers can be evacuated to a safe area within two minutes with winds as high as 34 knots from any direction. Author

N81-22393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MULTI-CHANNEL CHOPPER SYSTEM FOR A TOTAL OZONE MAPPING SPECTROMETER c35

Arlin J. Krueger and August O. Weilbach (Helvart Associates, Fullerton, Calif.) *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 63-75 refs (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 14B

A multi-channel chopper system designed and built to stringent specifications is providing an excellent performance for a total ozone mapping spectrometer (TOMS). State of the art machining technology, suitable material selection, and a way to hold and position the slit plate resulted in the instrument's better than expected performance. A shutter method used for internal calibration allows compensation for the occurrence of an unlikely wavelength shift during testing, launch, or during the orbiting life of the instrument. The TOMS is part of a payload on Nimbus 7 launched on October 24, 1978. E.D.K.

N81-22394*# American Science and Engineering, Inc., Cambridge, Mass.

A SYSTEMS APPROACH TO MECHANISMS FOR A WHITE LIGHT CORONAGRAPH X-RAY XUV TELESCOPE c74

Richard Mastronardi and Richard E. Cabral *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 77-90 (For primary document see N81-22388 13-39) (Grant NSF ATM-77-23757)

Avail: NTIS HC A19/MF A01 CSCL 20F

A combined instrument package containing nine mechanisms was designed and developed for the international solar polar mission (ISPM). This complement of instruments, commonly called the CXX, is the only imaging system on either the NASA or ESA spacecraft and consists of a white light coronagraph mounted parallel to a combined X-ray and extreme ultra-violet (XUV) telescope. Requirements for and implementation of mechanisms in the CXX instrument are discussed. E.D.K.

N81-22395*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COALIGNMENT OF SPACECRAFT EXPERIMENTS c12

Robert E. Federline *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 91-113 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 22A

On February 14, 1980, the solar maximum mission (SMM) satellite was launched into orbit with experiments to monitor

solar activity. In order to obtain common object observations, experiments must be coaligned within 90 arc-seconds of the spacecraft pointing vector. Hardware designed to minimize structural and thermal distortions of the experiment support plate is described. Coalignment was provided through control of interface which combined flexible blades to limit load transfer and spherical seats for alignment reference. E.D.K.

N81-22396*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ZERO GRAVITY TESTING OF FLEXIBLE SOLAR ARRAYS **c20**

D. T. Chung and L. E. Young *In its* The 15th Aerospace Mech. Symp. May 1981 p 115-136 refs Prepared in cooperation with Lockheed Missiles and Space Co., Sunnyvale, Calif. (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 21C

Zero gravity testing in the KC-135 aircraft of flat fold flexible solar array test specimens sufficiently demonstrated the adequacy of the panel design. The aircraft flight crew provided invaluable assistance and significantly contributed to the design and development of the flexible solar array, and ultimately to the potential success of the solar electric propulsion solar array shuttle flight experiment program. E.D.K.

N81-22397*# Martin Marietta Aerospace, Denver, Colo.

SPACE DEPLOYABLE TRUSS STRUCTURE DESIGN **c14**

John V. Coyner, Jr. and William H. Tobey *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 137-146 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 22B

The development status of the deployable box truss structure is summarized. Potential applications for this structural system are described. Structural and component design requirements derived from these applications are discussed. Components of prototype 4.6 m cubes which incorporate graphite/epoxy structural members, fittings, and mechanisms are described. The benefits of the component designs and their respective manufacturing processes are presented. E.D.K.

N81-22398*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

ON THE DESIGN OF LARGE SPACE DEPLOYABLE MODULAR ANTENNA REFLECTORS **c14**

J. W. Ribble and A. A. Woods, Jr. *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 147-157 ref (For primary document see N81-22388 13-39) (Contract NAS1-14887)

Avail: NTIS HC A19/MF A01 CSCL 22B

The deployment kinematics, stowing philosophy, and deployment sequencing for large deployable antenna modules were verified. Mesh attachment methods compatible with full scale modules were devised. Parametric studies of large modular reflectors established size, mass, and aperture frequency capabilities for these assemblies. Preliminary studies were made devising means of delivering modules to orbit, and once there, of assembling the modules into complete modular antenna reflectors. The basic feasibility of creating mass efficient modules erectable into large structures in space was established. E.D.K.

N81-22399*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

THE TECHNOLOGY DEVELOPMENT METHODOLOGY FOR A CLASS OF LARGE DIAMETER SPACEBORNE DEPLOYABLE ANTENNAS **c14**

William D. Wade and Verdinal C. McKean *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 159-172 refs (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 22B

The application of thermally stable graphite epoxy materials in flexure is discussed and deployment mechanism designs that are adaptable to both the proof of concept and the full scale 100 meter system with no modification to the basic concept are presented. The ground deployment test techniques and mechanisms developed for ground demonstration and evaluation of large size antenna structures are presented to illustrate the complexities involved in supporting antenna structural elements in excess of 25 meters in length. Author

N81-22400*# Lockheed-Georgia Co., Marietta.

HIGH FREQUENCY DRIVE MECHANISM FOR AN ACTIVE CONTROLS SYSTEMS AIRCRAFT CONTROL SURFACE **c08**

Hugh E. Smith *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 173-188 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 01C

The mechanism was successfully utilized on a wind tunnel model tested in the transonic blow down tunnel. The mechanism is also applicable to a flying aircraft. Several interrelated mechanical subsystems were utilized, including a low inertia antibacklash drive mechanism for high frequency oscillation and a compact antibacklash drive mechanism for conversion of rotary motion to linear motion. E.D.K.

N81-22401*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).

A BAPTA EMPLOYING ROTARY TRANSFORMERS, STEPPER MOTORS AND CERAMIC BALL BEARINGS **c33**

W. Auer *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 189-203 refs (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 09A

The utilization of rotary transformers as an alternative to slip rings for the power transfer from solar panels to a satellite's main body could be advantageous, especially if an ac bus system is taken into consideration. Different approaches with main emphasis on the electromagnetic design were investigated and showed efficiencies of up to 99% with a 3 kW power capability. A solidly preloaded pair of ball bearings with ceramic balls assures proper transformer air gaps and acceptable torque changes over temperature and temperature gradients. The bearing and power transfer assembly is driven by a direct drive stepper motor with inherent redundancy properties and needs no caging mechanism. Author

N81-22402*# British Aerospace Dynamics Group, Bristol (England).

A MECHANICAL DRIVE FOR RETRACTABLE TELESCOPIC MASTS **c37**

M. E. Humphries *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 205-217 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 13I

Test results on the mechanical drive have indicated that the system is capable of deploying a typical telescopic mast under ambient conditions. The design can be considered for a wide range of space applications since, in theory, there is no limit to the number of tubes that can be deployed. The mechanical system offers a number of advantages over a gas driven system, such as the ability to retract and also provide a significant mass saving. E.D.K.

N81-22403*# Sener, S.A., Madrid (Spain). Dept. Aerospacial.

DESIGN AND DEVELOPMENT OF AN OPTICAL SCANNING MECHANISM (OSMA) WITH MINIMUM MOMENTUM TRANSFER **c74**

Leandro B. Fernandez Sainz, Erardo Herrera, Jose M. Bajo, and Harry J. Mallard *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 219-234 (For primary document see N81-22388 13-39)

Avail: NTIS HC A19/MF A01 CSCL 20F

The development model for an optical scanning mechanism assembly is described as being two equal inertial masses which collide with each other to minimize the momentum transfer to the satellite and other mounted instruments. The design criteria for the mirror, the compensating inertia structure and other components are given. The details of the design are discussed and related test results are presented, which show the validity of the design concept for momentum compensation. M.G.

N81-22404*# Societe Nationale Industrielle Aerospatiale, Cannes (France).

AN ANTENNA FINE POINTING MECHANISM c37
Bernard Hubert and Pierre Brunet *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 235-252 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

SOFA, a device designed for the highly accurate 2 axis pointing of antenna or any feature installed on a spacecraft is described. The major characteristic of this system is complete freedom from friction and wear out, resulting in numerous advantages, such as outstanding precision, virtually endless service life, high simplicity, and reliability. The sizing method is described and performances are analyzed. The results from analogue simulations are presented. A functional model of the electrical and mechanical parts was built and subjected to on ground tests using a 2 axis platform simulating the spacecraft's motions. The results obtained are thoroughly in keeping with the predictions and simulations. Various possible applications of the SOFA system are mentioned. M.G.

N81-22405*# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
AN ANTENNA POINTING MECHANISM FOR LARGE REFLECTOR ANTENNAS c37
Hans Heimerdinger *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 253-261 Sponsored in part by DFVLR (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

An antenna pointing mechanism for large reflector antennas on direct broadcasting communication satellites was built and tested. After listing the requirements and constraints for this equipment the model is described, and performance figures are given. Futhermore, results of the qualification level tests, including functional, vibrational, thermovacuum, and accelerated life tests are reported. These tests were completed successfully. Author

N81-22406*# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A DRIVE UNIT FOR THE INSTRUMENT POINTING SYSTEM c37
R. Birner and M. Roth *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 263-278 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

The requirements, capabilities, and unique design features of the instrument pointing system drive units (DU) are presented. The DU's are identical for all three gimbal axes (elevation, cross elevation, and azimuth) and provide alternating rotation of shaft versus the housing of + or - 180 deg. The design features include: two ball bearing cartridges using cemented carbide balls coated with TiC a layer; redundant brushless torque motors and resolvers; a load by-pass mechanism driven by a dc torque motor to off-load the bearings during ascent/descent, ground transportation, and to provide an emergency breaking capability; and cabling over each gimbal axis by means of cable follow-up consisting of 13 signal and 15 power flat band cable loops. Test results of disturbance torque characteristics are presented. M.G.

N81-22407*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SRB DEWATERING SET c20
Robert E. Wickham *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 279-289 refs (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 21H

The system components and operation of the space shuttle solid rocket booster (SRB) dewatering set are described. The SRB dewatering set consists of a nozzle plug, control console, remote control unit, power distribution unit, umbilical cable, interconnect cables, and various handling and storage items. The nozzle plug (NP) is a remotely controlled, tethered underwater vehicle that is launched from the retrieval vessel (RV) by a crane, descends down the side of the SRB, and is positioned below the SRB nozzle. A TV camera mounted at the top of the NP central core is used by the control console operator to visually guide the NP during descent and docking. The NP is then driven up and locked into the nozzle. Compressed air is passed through the umbilical from the RV, through the NP and into the SRB motor. The water inside the SRB is expelled causing the SRB to rotate to a near horizontal attitude on the surface of the water. M.G.

N81-22408*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE MAIN ENGINE: HYDRAULIC SYSTEM c20
Gerhard Geller and Carl D. Lamb *In its* the 15th Aerospace Mech. Symp. May 1981 p 291-301 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 21H

The hydraulic actuation system of the space shuttle main engine is discussed. The system consists of five electrohydraulic actuators and a single engine filter used to control the five different propellant valves, which in turn control thrust and mixture ratio of the space shuttle main engine. The hydraulic actuation system provides this control with a precision of 98.7 percent or an error in position no greater than 1.3 percent of full scale rotational travel for critical positions. M.G.

N81-22409*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF A WINDOW PROTECTION ASSEMBLY FOR A SHUTTLE EXPERIMENT c91
Obie H. Bradley, Jr. *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 303-329 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 14B

A window environmental protection assembly developed for the shuttle infrared leeside temperature experiment is described. The assembly consists of a carbon phenolic composite window mount which contains two silicon windows, a fibrous environmental protection plug to protect the windows during launch operations and ascent heating, a release mechanism used to jettison the plug just prior to atmospheric entry, and two pin puller mechanisms which retain the plug. The plug is released from the window mount assemblies using pneumatic pin pullers and separation springs in the release mechanism. The assembly was designed and tested to withstand the severe mechanical and thermal environments which could be experienced at the top of the shuttle orbiter vertical stabilizer during the ascent, on-orbit, and entry periods of the shuttle trajectory. M.G.

N81-22410*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LATCH MECHANISM FOR THE SPACE TELESCOPE c37
Hubert F. Schmidt *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 331-339 ref (For primary document see N81-22388 13-39)
(Contract NAS8-32697)
Avail: NTIS HC A19/MF A01 CSCL 13I

Latch mechanisms to secure, release, and relatch deployables on the Space Telescope are described. The latch mechanisms are mechanical pre-loading devices composed of a four-bar linkage driven by an electro-mechanical rotary actuator. The latch mechanism requirements, unique design features, analytical highlights, and the development testing are discussed. M.G.

N81-22411*# General Electric Co., Philadelphia, Pa. Space Div.
A FULLY REDUNDANT POWER HINGE FOR LANDSAT-D APPENDAGES c15
Frank E. Mamrol and Donald N. Matteo *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 341-355 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

The configuration and testing of a power driven hinge for deployment of the solar array and antenna boom for the LANDSAT-D spacecraft is discussed. The hinge is fully mechanically and electrically redundant and, thereby, can sustain a single point failure of any one motor (or its power supply), speed reducer, or bearing set without loss of its ability to function. This design utilizes the capability of the stepper motor drive to remove the flexibility of the drive train from the joint stiffness equation when the hinge is loaded against its stop. This feature precludes gapping of the joint under spacecraft maneuver loads even in the absence of a latching feature. Thus, retraction is easily accomplished by

motor reversal without the need for a solenoid function to remove the latch. M.G.

N81-22412*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPARATIVE EVALUATION OPERABILITY OF LARGE SPACE STRUCTURE CONNECTORS c14
Jack Stokes *In its* The 15th Aerospace Mech. Symp. May 1981 p 357-374 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22B

The evaluation of several connector concepts in the neutral buoyancy simulator is discussed. Parameters for evaluating the fasteners included subject comments and hardware damage. Evaluation results include a rank ordering of the candidates with descriptions of the acceptable and unacceptable points of each. General design recommendations established as a result of neutral buoyancy testing are defined. Recommendations include detailed hardware and operational design requirements. M.G.

N81-22413*# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A CLAMP MECHANISM FOR DEPLOYABLE THREE-TON PAYLOADS c37
R. Birner and H. Ral *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 375-390 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 13I

The requirements, capabilities, and unique design features of the instrument payload subsystem payload clamp assembly (PCA) are presented. The PCA is designed to have the flexibility to accommodate a wide payload range varying from 0.5 m to 3 m in diameter and from 500 kg to 3000 kg mass. This is achieved by modular clamp design in connection with replaceable struts. The design features include clamping of payload in a statically determined way and actuation of clamp latches by means of single linear actuator via ropes. The vibration and TV environmental conditions for the mechanism are extremely severe. A structural and prototype model was built. Test results of the operating characteristic are presented. In addition, problems of tribology are highlighted. M.G.

N81-22414*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACECRAFT AUTOMATIC UMBILICAL SYSTEM c14
R. W. Goldin (Lockheed Missiles and Space Co.), G. G. Jacquemin (Lockheed Missiles and Space Co.), and W. H. Johnson *In its* The 15th Aerospace Mech. Symp. May 1981 p 391-421 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 22D

An umbilical system design is described that incorporates all the features specified for a power system to payload interconnect capability. A proof-of-concept prototype of the umbilical system was built to determine experimentally the suitability of the threading characteristics of the ram mechanism and to verify freedom from cross threading. It is concluded that Berthing systems that utilize remote manipulator systems (RMS) can be simplified by using RMS targets, closed circuit TV cameras, tie into the RMS control system, and grapple-fixture and end-effector-like capture and secure mechanisms. To effect a remotely controlled umbilical interconnect in proximity with a manned spacecraft and to provide for extravehicular activity backup and maintenance capabilities, 18 different mechanisms are found to be necessary. The weight impact of proving for maintenance capability in a large multiple connector umbilical system was found to be in the order of +60 percent. M.G.

N81-22415*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE LONG DURATION EXPOSURE FACILITY STRUCTURAL INTERFACE c14
Moses J. Long *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 423-439 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 14B

The development of an efficient structural interface between the Long Duration Exposure Facility (LDEF) and the space shuttle orbiter is discussed. Thermal gradients and manufacturing tolerances restrict the number of retention points in the shuttle to four with no more than three in one plane. Loads during the powered exit, high drag reentry, and landing are also critical factors in the location of retention points. A LDEF design is described that meets all requirements while avoiding the structural weight penalties associated with an asymmetrical arrangement. The ground handling and assembly problems are resolved in an economical and effective manner. M.G.

N81-22416# Western Forest Products Lab., Vancouver (British Columbia).
MACHINE FOR DURATION-OF-LOAD TENSION TESTS OF DIMENSION LUMBER
P. Glos (Technische Univ., Munich) and J. D. Barrett Oct. 1980 25 p refs
(TR-15) Avail: NTIS HC A02/MF A01

Testing equipment developed for evaluating the duration-of-load effect for lumber loaded in parallel-to-grain tension is described. The main problems in this kind of testing are to grip the specimen securely over a long time period of up to several years and to maintain a defined load over the same long time period. It is inherent in long-term testing that many independent frames are required and, therefore, emphasis was placed on keeping the total cost of the apparatus to a minimum. Author

N81-22417*# National Aeronautics and Space Administration, Washington, D. C.
STRENGTH OF ANISOTROPIC WOOD AND SYNTHETIC MATERIALS
Ye. K. Ashkenazi Apr. 1981 185 p refs Transl. into ENGLISH of the book "Prochost Anizotropnykhdrevesnykh i Sinteicheskikh Materialov" Moscow, Lesnaya Promyshlennost Press, 1966 p 1-168 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76535) Avail: NTIS HC A09/MF A01 CSCL 20K

The possibility of using general formulas for determining the strength of different anisotropic materials is considered, and theoretical formulas are applied and confirmed by results of tests on various nonmetallic materials. Data are cited on the strength of wood, plywood, laminated wood plastics, fiber glass-reinforced plastics and directed polymer films. A.R.H.

N81-22418*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SINGLE FRACTURE TOUGHNESS PARAMETER FOR FIBROUS COMPOSITE LAMINATES
C. C. Poe, Jr. Mar. 1981 50 p refs Presented at 17th Ann. Meeting of SES, Atlanta, 15-17 Dec. 1980
(NASA-TM-81911) Avail: NTIS HC A03/MF A01 CSCL 20K

A general fracture toughness parameter Qc was previously derived and verified to be a material constant, independent of layup, for centrally cracked boron aluminum composite specimens. The specimens were made with various proportions of 0 and + or - 45 degree plies. A limited amount of data indicated that the ratio Qc/epsilon tuf where epsilon tuf is the ultimate tensile strain of the fibers, might be a constant for all composite laminates, regardless of material and layup. In that case, a single value of Qc/epsilon tuf could be used to predict the fracture toughness of all fibrous composite laminates from only the elastic constants and epsilon tuf. Values of Qc/epsilon tuf were calculated for centrally cracked specimens made from graphite/polyimide, graphite/epoxy, E glass/epoxy, boron/epoxy, and S glass graphite/epoxy materials with numerous layups. Within ordinary scatter, the data indicate that Qc/epsilon tuf is a constant for all laminates that did not split extensively at the crack tips or have other deviate failure modes. S.F.

N81-22419*# Lockheed-California Co., Burbank.
DESIGN CONSIDERATIONS FOR COMPOSITE FUSELAGE STRUCTURE OF COMMERCIAL TRANSPORT AIRCRAFT
G. W. Davis and I. F. Sakata Hampton, Va. NASA. Langley Research Center Mar. 1981 51 p refs
(Contract NAS1-15949)
(NASA-CR-159296; LR-29540) Avail: NTIS HC A04/MF A01 CSCL 20K

The structural, manufacturing, and service and environmental

considerations that could impact the design of composite fuselage structure for commercial transport aircraft application were explored. The severity of these considerations was assessed and the principal design drivers delineated. Technical issues and potential problem areas which must be resolved before sufficient confidence is established to commit to composite materials were defined. The key issues considered are: definition of composite fuselage design specifications, damage tolerance, and crashworthiness. E.A.K.

N81-22420# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
STRUCTURES AND MATERIALS PANEL
1980 97 p Presented at the 50th Meeting of the Struct. and Mater. Panel, Athens, Greece, Spring 1980
(AD-A089019) Avail: NTIS HC A05/MF A01 CSCL 20/11

Partial contents: Group and Committee Reports; (1) Aeroelasticity, (2) Impact Damage Tolerance, (3) Fracture Mechanics Design Methodology, (4) Composite Materials, (5) Critically Loaded Hole Technology, (6) Corrosion Fatigue, (7) Factors of Safety, (8) Corrosion, (9) R and D Cooperation, (10) Standard Aeroelastic Configurations, (11) Helicopter Fatigue, (12) Dynamic Environmental Qualification Techniques, (13) Dimensionally Stable Structures for Space, (14) Dynamic Response to Damaged Runways, (15) Advanced Casting Technology, (16) Maintenance in Service of High Temperature Parts, and (17) Fatigue Rated Fastener Systems. Proposals for New Activities: (1) Effects of Short Cracks, (2) NDT of Ceramic Materials, (3) CAD/CAM. GRA

N81-22421# Brown Univ., Providence, R. I. Materials Research Lab.
THE SIZE AND DENSITY OF INTERGRANULAR CARBIDE PLATES IN 1020 HRS AND THEIR ROLE DURING BRITTLE FRACTURE INITIATION: A PRELIMINARY REPORT
J. C. Lambropoulos, R. J. Asaro, R. H. Hawley, and J. Duffy Jan. 1981 25 p refs
(Contract DAAG29-80-K-0045)
(AD-A097022; ARO-17221.1-E) Avail: NTIS HC A02/MF A01 CSCL 11/6

The effect of microstructure on the dynamic and quasi-static fracture initiation in a plain carbon steel using an AISI 1020 steel with either a normalized microstructure or an isothermally transformed (at 550C) ferritic-pearlitic microstructure. Fracture toughness tests were conducted over the temperature range -130C to 65C and were complemented by high rate and quasi-static plasticity tests to provide necessary data on the mechanical behavior of both microstructures over the same temperature range and over approximately the same range of strain rates. Results show that the isothermally transformed microstructure is both stronger and rougher than the normalized microstructure at temperatures below about 18C where cleavage occurs. Above 18C, the fracture mode is fibrous in both microstructures and the toughness of the two microstructures are comparable. The quasi-static strength of the isothermally transformed microstructure is higher but the strength at higher strain rates is a little lower at temperatures above 18C. GRA

N81-22422# Army Engineer District, Nashville, Tenn.
DOCUMENTATION OF FINITE ELEMENT ANALYSES. REPORT 2: ANCHORED WALL MONOLITH, BAY SPRINGS LOCK
P. Thomas McGee Dec. 1980 84 p
(AD-A096481; WES-TR-K-80-4-2) Avail: NTIS HC A05/MF A01 CSCL 13/3

Bay Springs Lock and Dam, located in northeast Mississippi, is the northernmost of the system of locks and dams on the Tennessee-Tombigbee Waterway. The navigation lock will be formed by a combination of anchored chambered walls and gravity-type gate blocks, with a reinforced concrete floor strut. The 'anchored wall' monoliths differ from conventional gravity-type monoliths in that posttensioned tendons engaging rock account in part for the stability of the walls. The anchored wall, with its concrete-foundation-tendon interaction characteristics, poses a formidable challenge to analysis by classical methods, making it an ideal problem for solution by a computerized, numerical analysis technique. Due to the complex geometry of the structure, mutiple materials, post-tensioning of the tendons, and the attendant boundary conditions, the finite element method was selected as the only viable analysis technique for determining the state of stress in the anchored wall monolith and its surrounding foundation. The ANSYS FEM program was used, primarily to take advantage of its nonlinear boundary element which was used to approximate the interaction at material interfaces. Solutions for the various load cases were displayed graphically in numerous pressure, stress, and deflected shape diagrams. Results confirm the assumption of the rigid body stability analysis program used to size the tendons of the anchored wall monolith and indicate a safe design with regard to the established criteria. GRA

N81-22423# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
NASTRAN SAMPLE PROBLEM COMPUTER OUTPUT
Gordon C. Everstine and Myles M. Hurwitz Feb. 1981 421 p refs
(AD-A096867; DTNSRDC/CMLD-81-04) Avail: NTIS HC A18/MF A01 CSCL 09/2

This is a compilation of computer output for 23 sample problems illustrating the basic capabilities of the NASTRAN structural analysis computer program. These problems are used primarily in NASTRAN training courses. Problem descriptions appear in a companion report DTNSRDC/CMLD-81-05. GRA

N81-22424# California Univ., Berkeley. Dept. of Mechanical Engineering.
FINITE DEFORMATION OF ELASTIC RODS AND SHELLS
P. M. Naghdi Sep. 1980 86 p refs
(Contract N00014-75-C-0148)
(AD-A096856; UCB/AM-80-7) Avail: NTIS HC A05/MF A01 CSCL 20/11

The objective of this paper is to present an account of recent developments in the direct formulation of theories of rods and shells based on 1 and 2 dimensional continuum models originating in the works of Duhem and E. and F. Cosserat. Following some preliminaries and description of (3 dimensional) shell-like and rod-like bodies, the rest of the paper is arranged in two parts, namely Part A (for shells) and Part B (for rods) and can be read independently of each other. In each part, after providing the main ingredients of the direct model and a statement of the conservation laws, a rapid outline is given of the derivation of the basic equations and nonlinear constitutive equations for elastic materials. Each part also includes a discussion of constrained theories and an account of recent developments on the subject. GRA

N81-22425# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
NASTRAN THEORY AND APPLICATION COURSE SUPPLEMENT
Gordon C. Everstine and Myles M. Hurwitz Feb. 1981 75 p refs
(AD-A096820; DTNSRDC/CMLD-81-05) Avail: NTIS HC A04/MF A01 CSCL 09/2

Contents: An Introduction to the Finite Element method; Demonstration Problems; Workshop Problems; BANDIT Example; Time and Core Estimation; Basic Plotting; NASTRAN Elements; Structural symmetry; Grid Point Sequencing Considerations; BANDIT User's Guide. GRA

N81-22426# Akron Univ., Ohio. Coll. of Engineering.
EVALUATION OF ADINA. PART 1: THEORY AND PROGRAMMING DESCRIPTIONS Final Report .
T. Y. Chang and J. Padovan 8 Jun. 1980 136 p refs
(Contract N00014-78-C-0691)
(AD-A096678; AUE-801-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 20/11

An evaluation of 1977 ADINA, a general purpose nonlinear finite element Program, was conducted. The evaluation work consists of the review of its theoretical basis, nonlinear static and dynamic solution algorithms, and program architecture. A discussion of the program is also made with respect to its nonlinear analysis capability and limitations. GRA

N81-22427# Akron Univ., Ohio. Coll. of Engineering.
EVALUATION OF ADINA. PART 2: OPERATING CHARACTERISTICS

J. Padovan and T. Y. Chang 8 Jun. 1980 160 p refs
(Contract N00014-78-C-0691)
(AD-A096681; AUE-802-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 20/11

An advanced evaluation of the various solution algorithms available in the 1977 ADINA was made. The main objective of the evaluation work is to assess the inherent characteristics of the nonlinear static, dynamic and eigenvalue solution branches of the program. Several benchmark problems were run to establish the numerical characteristics of the solution algorithms adopted by ADINA. GRA

N81-22428# Texas Univ. at Arlington. Mechanical Engineering.
AUGER ELECTRON SPECTROSCOPY AS APPLIED TO THE STUDY OF THE FRACTURE BEHAVIOR OF MATERIALS
Michael Schmerling, Duane Finello, and H. L. Marcus 1980 33 p refs
(Contract N00014-78-C-0094)
(AD-A096625) Avail: NTIS HC A03/MF A01 CSCL 07/4

This paper describes the use of AES in a wide range of fracture problems. Included are fracture studies of iron, aluminum based alloys and metal matrix/ceramic composites. The paper also describes how the AES analysis is combined with the SEM, inert ion sputtering, SIMS, ESCA, and other surface and near surface tools to assist in determining the fracture behavior of materials in various environments. GRA

N81-22429# Lockheed Missiles and Space Co., Palo Alto, Calif.
DAMAGE CHARACTERISTICS OF AN INFINITE CYLINDRICAL SHELL EXCITED BY A TRANSIENT ACOUSTIC WAVE Final Report, 1 Jul. 1979 - 31 Mar. 1980
T. L. Geers and C.-L. Yen Mar. 1981 29 p refs
(Contract N00014-79-C-0619)
(AD-A096686; LMSC-D686495) Avail: NTIS HC A03/MF A01 CSCL 20/11

An analytical/computational technique previously developed for determining the geometrically and constitutively nonlinear response of a submerged, infinite cylindrical shell to a transverse, transient acoustic wave is used to study the damage behavior of the shell. Incident waves of rectangular pressure-profile are considered, nonlinear transient response computations are performed, and damage results are described in terms of iso-damage curves based on extensional set strain. Results generated through the use of the doubly asymptotic approximation for treatmetn of the fluid-structure interaction differ appreciably from their exact counterparts. GRA

N81-22430# California Univ., Davis. Dept. of Mechanical Engineering.
RESIDUAL STRESS OF DIFFUSION BONDED ALUMINUM-TO-STAINLESS STEEL JOINS Final Report
Roderick D. Stroud and James F. Shackelford Sep. 1980 73 p refs
(Contract W-7405-eng-48)
(UCRL-15326) Avail: NTIS HC A04/MF A01

An X-ray method for determination of residual stress as a function of surface position on a metal sample is described. This method is capable of spatial resolution on the order of 0.040 inch (1 mm) and precision positioning of the sample along three orthogonal axes to better than 0.001 inch. A high precision sample holder was designed and fabricated for this purpose. Apparent residual stress was found to be a strong function of sample position with respect to the axis of rotation of the diffractometer circle. This relationship is on the order of 400 to 500 Kpsi/inch for aluminum. Comparison was made between applied stress values obtained with strain gage output and those obtained by X-ray diffraction. Correlation was good with the accuracy of stress measurements being approximately + or - 500 psi. DOE

N81-22431# California Univ., Livermore. Lawrence Livermore Lab.
USING SUBJECTIVE PERCENTILES AND TEST DATA FOR ESTIMATING FRAGILITY FUNCTIONS
L. L. George and R. W. Mensing 15 Jan. 1981 26 p refs Presented at DOE Statistical Symp., Berkeley, Calif., 29 Oct. 1980
(Contract W-7405-eng-48)
(UCRL-84157; CONF-801045-7) Avail: NTIS HC A03/MF A01

Fragility functions are cumulative distribution functions (cdfs) of strength at failure. They are needed for reliability analyses of systems such as power generation and transmission systems. The following are derived least squares parameter estimators for normal and lognormal cdfs, based on subjective percentiles (the method is applicable to any invertible cdf); a composite fragility function for combining several failure modes; estimators of variation within and between groups of experts for nonidentically distributed subjective percentiles; weighted least squares estimators when subjective percentiles have higher variation at higher percents; and weighted least squares and Bayes parameter estimators based on combining subjective percentile and test data. DOE

N81-22432# Sandia Labs., Livermore, Calif.
UNIFIED CREEP-PLASTICITY MODEL FOR HALITE
R. D. Krieg Nov. 1980 12 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1195) Avail: NTIS HC A02/MF A01

A constitutive model was developed which describes the behavior observed in an extensive set of triaxial creep tests. Analysis of these tests showed that a single deformation mechanism seems to be operative over the stress and temperature range of interest so that the secondary creep data can be represented by a power of the stress over the entire test range. This simple behavior allowed a unified creep-plasticity model to be applied with some confidence. The resulting model recognizes no inherent difference between plastic and creep strains yet models the total inelastic strain reasonably well including primary and secondary creep and reverse loadings. A multiaxial formulation is applied with a back stress. A Bauschinger effect is exhibited as a consequence and is present regardless of the time scale over which the loading is applied. DOE

N81-22433# Oxford Univ. (England). Engineering Lab.
GENERAL BENDING-TORSION THEORY
W. S. Hemp 1980 11 p refs
(OUEL-1320/80) Avail: NTIS HC A02/MF A01

A proof of Reissner's variational principle is given together with examples of its application. This principle allows an independent variation of displacements and stresses. The proof given is restricted to a small deformation. An expression was developed for the virtual work performed on an isotropic elastic body referred to Cartesian coordinates (x, y, z) with a Young's modulus E, a shear modulus G and a Poisson's ration NU loaded by external forces and subject to kinematic restrictions. Classical ordinary bending theory parameters were first obtained. A more general theory was then developed by adding Saint Venant displacements for torsion. Author (ESA)

N81-22434# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
DYNAMIC ANALYSIS OF AN ARCHED DAM, USING COHERENT LIGHT VIBRATION SENSOR [ANALISI DINAMICA DI UNA DIGA AD ARCO MEDIANTE UN SENSORE DI VIBRAZIONI A LUCE COERENTE]
S. C. L. Botcherby, M. Corti, and F. Parmigiani 1980 10 p refs In ITALIAN Presented at 2nd Natl. Congr. of Quantum and Plasma Electron., Palermo, Italy, 20-22 May 1980 Sponsored by Ente Nazionale per l'Energia Electricca
(CISE-1646) Avail: NTIS HC A02/MF A01

A vibration sensor was developed using a 5 mW He-Ne laser in order to measure the dynamic characteristics of an arched dam. The instrument is based on a Michelson polarization interferometer. The system has an amplitude resolution of one micron for measurements done at a distance of 200 m, for frequencies between 0.1 and 150 Hz. For narrow band signal analysis, the instrument has a resolution of 0.01 micron. These results were obtained by optimization of the electro optic system and by taking special precaution in reducing noise sources. Author (ESA)

N81-22435# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung

Strukturberechnung.

INELASTIC BUCKLING OF COLUMNS OF L AND U CROSS SECTION

Rolf Zick 1980 54 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-709) (DFVLR-FB-80-31) Avail: NTIS HC A05/MF A01

The buckling stresses of axially compressed columns having either U or L cross section are determined using the Prandtl-Reuss law and the method of transfer matrices. The deflections of the cross sectional elements are described by the plate equation and the linearized differential equation for planar deformations. The results are discussed in terms of stress-strain laws and are satisfactorily compared with test measurements. Agreement is also shown with a standard method of calculation which is briefly described. Author (ESA)

N81-22436# Shock and Vibration Information Center (Defense), Washington, D. C.

THE SHOCK AND VIBRATION DIGEST, VOLUME 13, NUMBER 3

Judith Nagle-Eshleman, ed. Mar. 1981 91 p refs (AD-A096909) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set CSCL 20K

The goal of the digest is to provide efficient transfer of sound, shock, and vibration technology among researchers and practicing engineers. Subjective and objective analyses of the literature are provided along with news and editorial materials. Topics include aircraft design and safety, noise reduction, acoustical impedance, and dynamic structural analysis. For individual titles, see N81-22437 through N81-22438.

N81-22437# Lockheed-California Co., Burbank.

AIRCRAFT CRASH DYNAMICS: SOME MAJOR CONSIDERATIONS **c03**

In The Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 13, No. 3 Mar. 1981 p 3-6 refs (For primary document see N81-22436 13-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D. C. $15.00/set CSCL 01/9

The considerations are aircraft crash environments, available analytical methods, and occupant protection. The aircraft crash environment varies depending on aircraft size, configuration, and usage. Current crash design requirements for military and civil helicopters, small airplanes, and large airplanes are presented. Analytical modeling of crash behavior requires three levels of capability: simple, intermediate, and detailed. Brief descriptions of methods and reference simulations are provided. Occupant protection, which is the goal of the crash design effort, is related to a design in which the load capability of the various systems is compatible with the crash environment. T.M.

N81-22438# Sherbrooke Univ. (Quebec). Dept. of Mechanical Engineering.

IMPEDANCE METHODS FOR MACHINE ANALYSIS **c37**

M. Massoud *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 13, No. 3 Mar. 1981 p 17-21 refs (For primary document see N81-22436 13-39)

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D. C. $15.00/set CSCL 13/9

Basic definitions, mathematical background, and test procedures of the impedance of mechanical systems are given. The impedance of acoustical phenomena associated with mechanical systems is emphasized. T.M.

42 GEOSCIENCES (GENERAL)

N81-22439*# California Univ., Berkeley.

DEVELOPMENT OF EXPERIMENTAL CONCEPTS FOR INVESTIGATING THE STRENGTH BEHAVIOR OF FINE-GRAINED COHESIVE SOIL IN THE SPACELAB/SPACE SHUTTLE ZERO-G ENVIRONMENT Final Report

Rudolph Bonaparte and James K. Mitchell Washington NASA Apr. 1981 129 p refs (Contract NAS8-33449) (NASA-CR-3365) Avail: NTIS HC A07/MF A01 CSCL 20K

Three different sets of tests are proposed for the NASA Spacelab experimental program. The first of tests, designed to measure the true cohesion of several different soils, would be carried out in space through use of a specially prepared direct shear apparatus. As part of this first series of tests, it is recommended that a set of drained unconfined compression tests be performed terrestrially on the same soils as tested in space. A form of the direct tension test is planned to measure the true tensile strength of the same types of soils used in the first series of tests. The direct tension tests could be performed terrestrially. The combined results of the direct shear tests, direct tension tests, and unconfined compression tests can be used to construct approximate failure envelopes for the soils tested in the region of the stress origin. Relationships between true cohesion and true tensile strength can also be investigated. In addition, the role of physio-chemical variables should be studied. The third set of tests involves using a multiaxial cubical or true triaxial test apparatus to investigate the influence of gravity induced fabric anisotropy and stress nonhomogeneities on the stress strain behavior of cohesive soils at low effective stress levels. These tests would involve both in space and terrestrial laboratory testing. A.R.H.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-22440 Utah State Univ., Logan.

HYDROLOGIC ASPECTS OF WATER HARVESTING ON PROCESSED OIL SHALE, A SALINE MEDIUM Ph.D. Thesis

Ali Malek 1981 219 p

Avail: Univ. Microfilms Order No. 8104111

Hydrologic characteristics of processed shale are discussed, with the possibility of applying water harvesting techniques to supply additional water to supplement natural precipitation for establishing plants on a spent shale pile for rehabilitation. Four types of soil stabilizing materials were tested for their efficiency to harvest water. Natural precipitation of the area was simulated by applying a total of 13.4 cm of artificial rain in four distinct times, using a rainfall simulator. For all treatments, water harvesting efficiency increased during the experiment despite the damaging and disintegration of the materials which would generally act to increase the water percolation and reduce runoff. Styrene butadiene generally produced the highest amount of harvested water of runoff followed by paraffin treated plots. Plots treated with mulch produced the least amount of runoff. Dissert. Abstr.

N81-22441 Arizona Univ., Tucson.

STATISTICAL ANALYSES AND STOCHASTIC MODELING OF THE CORTARO AQUIFER IN SOUTHERN ARIZONA Ph.D. Thesis

Abdalla Abdurazig Binsariti 1980 258 p

Avail: Univ. Microfilms Order No. 8106931

Transmissivity, specific capacity, and steady state hydraulic head data collected from the Cortaro aquifer in Southern Arizona are analyzed statistically by means of regression and Kriging techniques. The statistics obtained in this manner are used to develop a stochastic model of the aquifer based on the finite element and Monte Carlo simulation methods. Three stages of generated head uncertainties are considered: (1) nonconditional, (2) conditional on transmissivity data and (3) conditional on both transmissivity and initial hydraulic head data (or inverse method). We found that simulated head values in stages 1 and 2 are associated with high variance amounting to 144 square feet. When the statistics obtained from regression and Kriging in stage 2 are processed by means of the statistical inverse method of Neuman (1980), the result is a drastic reduction in the input head variance amounting to 75 percent reduction in the input head variance (i.e., 144 square ft). Dissert. Abstr.

N81-22442 Ohio State Univ., Columbus.

MODELING THE STRUCTURE OF CARTOGRAPHIC

INFORMATION FOR QUERY PROCESSING Ph.D. Thesis
Timothy Lee Nyerges 1980 211 p
Avail: Univ. Microfilms Order No. 8107373

Concepts from cartography, linguistics, picture processing and data base theory are utilized in modeling the structure of cartographic information in virtual maps. A linguistic model that characterizes a cartographic information structure is presented. A multidimensional grammar serves as the basis of the linguistic model. The grammar is composed of production rules, lexical rules, transformational rules and a vocabulary of nonterminal and terminal cartographic objects. Production rules and lexical rules are used to generate the underlying, conceptual structure among nonterminal objects of a virtual map. Transformational rules operate on the ordering of nonterminal objects to produce a cartographic display of the terminal objects. Cartographic query processing is defined as a method of manipulation and display of cartographic information that employs a high level language of English-like statements as a communication interface. A cartographic query system, CART-QUERY, developed to demonstrate the feasibility of information structuring is discussed and evaluated. Dissert. Abstr.

N81-22443*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
INVESTIGATION OF GEOMAGNETIC FIELD FORECASTING AND FLUID DYNAMICS OF THE CORE Quarterly Status Technical Progress Report, 30 Sep. - 31 Dec. 1980
Edward R. Benton, Principal Invesgitator 1 Jan. 1981 5 p ERTS
(Contract NAS5-25957)
(E81-10107; NASA-CR-164101; QSTPR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

An additional approach is being taken to address the problem of how to decide where to truncate spherical harmonic representations of geomagnetic data. The idea is to simply evaluate some aspect of interest at successively higher levels of truncation and then to chose that value of truncation level (N) which gives the most reasonable appearance of convergence. The preliminary determination of the onset of relative numerical stability at a truncation level of N=7 in two independent studies is thought to be a potentially significant result of practical value for field modeling. It requires further substantiation and explanation before dissemination. A.R.H.

N81-22444*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
COMPATIBILITY STUDY OF THE MAGSAT DATA AND AEROMAGNETIC DATA IN THE EASTERN PIEDMONT OF US Progress Report
I. J. Won, Principal Investigator Dec. 1980 12 p ERTS
(Contract NAS5-26157)
(E81-10108; NASA-CR-164102) Avail: NTIS HC A02/MF A01 CSCL 08F

Data from a 2 day period recorded by Magsat were used to produce world magnetic maps of the scalar total field and three vector component total fields. Subtracting the reference field of Magsat 6/80, a scalar anomalous field and three vector component anomalous fields were also mapped. After removing 718 bad points from the original data, every fifth point was picked for contouring. While the main geomagnetic field of the Earth is surprisingly well mapped considering the short data period, the anomaly maps suffer from data sparseness. The entire Magsat file collected at altitudes of 500-700 m in nonmountainous terrain and at 900-1,000 m in mountainous terrain was averaged to reduce the total data to 6,500 measurements, yielding a 0.1 deg sampling interval along the flight path. A U.S. aeromagnetic anomaly surface map was produced and the field was upward continued to a 300 km altitude. Differences in anomaly structure between the POGO data and the map produced were attributed to insufficient removal of the reference field. Reprocessing of the data using the GSFC reference field (9/80-2) should remove the low harmonic field and improve the anomalous field structure. A.R.H.

N81-22445*# Business and Technological Systems, Inc., Seabrook, Md.
MAGSAT SCIENCE INVESTIGATIONS Quarterly Report, 9 Sep. - 30 Nov. 1980
30 Nov. 1980 4 p ERTS
(Contract NAS5-26328)
(E81-10109; NASA-CR-164103; QR-1) Avail: NTIS HC A02/MF A01 CSCL 05B

Existing software is being modified to take any combination of component or scalar data in profile form and invert it to a discrete-source magnetization distribution for sources having arbitrary equal-area spacing. The option of constraining both source and directions and magnitude is included. Software for spectral depth-to-magnetic bottom estimates is under development. The software is to be thoroughly listed on synthetic data and applied to the NOO survey data and to NURE data for the southern Rio Grande Rift. Swanberg's silica geotemperature data for the U.S. was digitized for heat flow studies. A.R.H.

N81-22446*# Business and Technological Systems, Inc., Seabrook, Md.
EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA Quarterly Report, 1 Jul. - 30 Sep. 1980
30 Sep. 1980 4 p ERTS
(Contract NAS5-26047)
(E81-10110; NASA-CR-164104) Avail: NTIS HC A02/MF A01 CSCL 08G

A graphic software package was developed to plot the dipole positions for a particular model on a world map. An arrow is drawn at each dipole in the direction of the horizontal magnetization vector, with length proportional to the horizontal magnitude. A contouring package represents the radical component of the magnetization vector. Based on quiet Magsat data, several dipole models were derived. These are being verified against each other and against MGST (6/80) data set as to goodness of fit and stability of solution. The spatial power spectra computed from spherical harmonic expansions of the dipole models is being analyzed relative to crustal and core content. The power spectra for one of the dipole models and a spherical harmonic model based on Magsat data through degree and order 23 is presented. A.R.H.

N81-22447*# Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
MAGSAT INVESTIGATION Progress Report
D. H. Hall, Principal Investigator 19 Nov. 1980 1 p Sponsored by NASA ERTS
(E81-10111; NASA-CR-164105) Avail: NTIS HC A02/MF A01 CSCL 08G

A computer program was prepared for modeling segments of the Earth's crust allowing for heterogeneity in magnetization in calculating the Earth's field at Magsat heights. This permits investigation of a large number of possible models in assessing the magnetic signatures of subprovinces of the Canadian shield. The fit between the model field and observed fields is optimized in a semi-automatic procedure. A.R.H.

N81-22448*# North Carolina State Univ., Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
A NEW METHOD OF CURIE DEPTH EVALUATION FROM MAGNETIC DATA: THEORY Progress Report
I. J. Won, Principal Investigator 25 Feb. 1981 9 p refs ERTS
(Contract NAS5-26157)
(E81-10112; NASA-CR-164106) Avail: NTIS HC A02/MF A01 CSCL 08G

An approach to estimating the Curie point isotherm uses the classical Gauss method inverting a system of nonlinear equations. The method, slightly modified by a differential correction technique, directly inverts filtered Magsat data to calculate the crustal structure above the Curie depth, which is modeled as a magnetized layer of varying thickness and susceptibility. Since the depth below the layer is assumed to be nonmagnetic, the bottom of the layer is interpreted as the Curie depth. The method, once fully developed, tested, and compared with previous work by others, is to be applied to a portion of the eastern U.S. when sufficient Magsat data are accumulated for the region. A.R.H.

N81-22449*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF VEGETATION AND OTHER EARTH

RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. 1: LANDSAT. 2: REMOTE SENSING OF VOLCANIC EMISSIONS
Semiannual Status Report, 1 Aug. 1980 - 31 Jan. 1981
Richard W. Birnie and Richard E. Stoiber, Principal Investigators 31 Jan. 1981 33 p ERTS
(Contract NCC5-22)
(E81-10133; NASA-CR-164122; SASR-2) Avail: NTIS HC A03/MF A01 CSCL 08K

A fanning technique based on a simplistic physical model provided a classification algorithm for mixture landscapes. Results of applications to LANDSAT inventory of 1.5 million acres of forest land in Northern Maine are presented. Signatures for potential deer year habitat in New Hampshire were developed. Volcanic activity was monitored in Nicaragua, El Salvador, and Guatemala along with the Mt. St. Helens eruption. Emphasis in the monitoring was placed on the remote sensing of SO2 concentrations in the plumes of the volcanoes. T.M.

N81-22450*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STATEWIDE LANDSAT INVENTORY OF CALIFORNIA FORESTS
William Likens and David Peterson, Principal Investigators Feb. 1981 28 p refs ERTS
(E81-10134; NASA-TM-81255; A-8445) Avail: NTIS HC A03/MF A01 CSCL 02F

Six forest cover categories were mapped, along with 10 general land cover classes. To map the state's 100 million acres, 1.6 acre mapping units were utilized. Map products were created. Standing forest acreage for the state was computed to be 26.8 million acres. T.M.

N81-22451*# Wisconsin Univ. - Madison. Environmental Remote Sensing Center.
WETLAND MAPPING FROM DIGITIZED AERIAL PHOTOGRAPHY
F. L. Scarpace, B. K. Quirk, R. W. Kiefer, and S. L. Wynn 1981 24 p refs Sponsored by NASA Original contains color illustrations
(NASA-CR-164199) Avail: NTIS HC A02/MF A01 CSCL 08B

Computer assisted interpretation of small scale aerial imagery was found to be a cost effective and accurate method of mapping complex vegetation patterns if high resolution information is desired. This type of technique is suited for problems such as monitoring changes in species composition due to environmental factors and is a feasible method of monitoring and mapping large areas of wetlands. The technique has the added advantage of being in a computer compatible form which can be transformed into any georeference system of interest. E.D.K.

N81-22452*# Cornell Univ., Ithaca, N. Y. Dept. of Geological Sciences.
PRECISE LEVELING, SPACE GEODESY AND GEODYNAMICS Final Report, 1 Apr. 1980 - 31 Mar. 1981
Robert Reilinger 1981 62 p refs
(Contract NCC5-4)
(NASA-CR-164191) Avail: NTIS HC A04/MF A01 CSCL 08B

The implications of currently available leveling data on understanding the crustal dynamics of the continental United States are investigated. Neotectonic deformation, near surface movements, systematic errors in releveling measurements, and the implications of this information for earthquake prediction are described. Vertical crustal movements in the vicinity of the 1931 Valentine, Texas, earthquake which may represent coseismic deformation are investigated. The detection of vertical fault displacements by precise leveling in western Kentucky is reported. An empirical basis for defining releveling anomalies and its implications for crustal deformation in southern California is presented. Releveling measurements in the eastern United States and their meaning in the context of possible crustal deformation, including uplift of the Appalachian Mountains, eastward tilting of the Atlantic Coastal Plain, and apparent movements associated with a number of structural features along the east coast, are reported. J.D.H.

N81-22453*# GMD Systems, Lancaster, Calif.
BASELINE MATHEMATICS AND GEODETICS FOR TRACKING OPERATIONS
Robert James Apr. 1981 225 p refs
(Contract NAS4-2678)
(NASA-CR-163102; GMD-802678) Avail: NTIS HC A10/MF A01 CSCL 12A

Various geodetic and mapping algorithms are analyzed as they apply to radar tracking systems and tested in extended BASIC computer language for real time computer applications. Closed-form approaches to the solution of converting Earth centered coordinates to latitude, longitude, and altitude are compared with classical approximations. A simplified approach to atmospheric refractivity called gradient refraction is compared with conventional ray tracing processes. An extremely detailed set of documentation which provides the theory, derivations, and application of algorithms used in the programs is included. Validation methods are also presented for testing the accuracy of the algorithms. J.M.S.

N81-22454*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT LANGUAGE AT OUR REACH. FIRST SWEDISH SATELLITE. CIVILIZATION DETECTORS
D. L. Wayne and V. Bravo Apr. 1981 18 p Transl. into ENGLISH from Aerospacia (Argentina), Nov. - Dec. 1980 p 50-58 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76477) Avail: NTIS HC A02/MF A01 CSCL 05B

Information on the use of LANDSAT data by Argentina is presented. Details on a Swedish satellite to be completed in 1984 and to be called VIKING are reported. Attempts to contact other civilizations in space by the use of radiotelescopes are discussed. T.M.

N81-22455*# National Aeronautics and Space Administration, Washington, D. C.
PUBLICATION OF THE MAPS OF TENKE AND MANONO (ZAIRE) FROM LANDSAT DATA
Musungayi Yampania (Presidential Study Service, Kinshasa, Republic of Zaire) Mar. 1981 39 p refs Transl. into ENGLISH of "Mise a jour des cartes de Tenke et Manono (Zaire) a partir des donnees LANDSAT" Rept. SDSU-RSI-VISP-81-02, Jan. 1981 31 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by South Dakota State Univ., Brookings
(Contract NASw-3198)
(NASA-TM-76479; SDSU-RSI-VISP-81-02) Avail: NTIS HC A03/MF A01 CSCL 08B

The collection of cartographic data on Zaire up to the present time was based on aerial reconnaissance. This approach is very expensive if repetitive coverage is required in such a large country. The integration with the LANDSAT program among the data collection systems improves the mapping efforts substantially. T.M.

N81-22456# Colorado School of Mines, Golden.
SAMPLING DESIGNS FOR GEOCHEMICAL BASELINE STUDIES IN THE COLORADO OIL SHALE REGION: A MANUAL FOR PRACTICAL APPLICATION
Ronlad W. Klusman, Charles D. Ringrose, Robert J. Candito, Bruce Zuccaro, David W. Rutherford, and Walter E. Dean (U.S. Geological Survey) Jun. 1980 193 p refs
(Contract DE-AC02-79EV-10298)
(DOE/EV-10298/2) Avail: NTIS HC A09/MF A01

A rationale for sampling designs, and results of geochemical baseline studies in the Colorado portion of the oil-shale region are presented. The manual is divided into five major parts. The first is a suggested sampling protocol, presented in outline form, for guiding baseline studies in this area. The second section is background information on the physical features of the area of study, trace elements of significance occurring in oil shale, and the sample media used in these studies. The third section is concerned primarily with sampling design and its application to the geochemical studies of the oil shale region. The last sections, in the form of appendices, provide actual data and illustrate in a systematic manner, the calculations performed to obtain the

various summary data. The geochemistry of trace elements and the parameters of importance influencing their behavior in natural systems are also discussed. DOE

N81-22457# Technische Univ., Graz (Austria). Inst. for National Surveying and Photogrammetry.
AUTOMATED REGISTRATION OF SCANNED SATELLITE IMAGERY WITH A DIGITAL MAP DATA BASE Final Technical Report, Feb. 1978 - Nov. 1980
Franz W. Leberl and Walter Kropatsch Nov. 1980 159 p refs
(Grant DA-ERO-78-G-044; DA Proj. 1T1-61102-BH-57)
(AD-A096132) Avail: NTIS HC A08/MF A01 CSCL 09/2

Analysis of digital remote sensing images can, and should employ all the information that is available about the area of interest. Maps often do exist, so that the question arises how map information can be automatically used to direct image analysis. With an appropriate organization of digital map data banks it becomes possible to merge image and map. Attention is concentrated on areal features. The algorithms and data structures used for the task are described and experiences using specific examples of LANDSAT images in southern Germany and Austria to automatically recognize features for subsequent rectification are reported. GRA

N81-22458# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
APPLICATIONS OF GROUND-BASED REMOTE SENSING TECHNIQUES Final Report
Donald R. Fitzgerald 1 Oct. 1980 34 p refs
(AF Proj. 6670)
(AD-A097044; AFGL-TR-80-0315; AFGL-IP-292) Avail: NTIS HC A03/MF A01 CSCL 17/5

The development of selected techniques for the remote measurement of winds, shear, turbulence, aerosols, and temperature and moisture profiles has been outlined in some detail. Emphasis has been placed on techniques that may provide high-resolution data in the vicinity of airbases. A representative and fairly extensive list of references to the evolution of the various techniques has been prepared. The FM-CW radar and CO2 pulse Doppler laser have been identified as valuable for low-level wind and shear measurements. Strong downdraft conditions may be identified through use of infrared thermal anomaly detectors. Temperature and moisture profiles may be obtained through a combination of active sounding for profile inflection points and thermal or microwave multichannel radiometry. GRA

N81-22459# Sandia Labs., Livermore, Calif.
PROJECT DEEP STEAM Quarterly Report, 1 Apr. - 1 Jun. 1980
R. L. Fox, R. G. Clay, A. B. Donaldson, S. W. Eisenhawer, D. R. Johnson, W. D. Lyle, and A. J. Mulac Jan. 1981 45 p refs (Contract DE-AC04-76DP-00789)
(SAND-80-2631) Avail: NTIS HC A03/MF A01

The technology required to economically produce heavy oil from deep reservoirs was studied including thermally efficient delivery systems and downhole steam generation systems. The initial field testing of a downhole steam generator design which was operated on the surface was completed. Design and fabrication of downhole generation systems for the next phase of testing are under development. Full scale simulation tests of thermally efficient delivery strings at the Tacoma, Washington test facility have continued. A comparison of two designs for calcium silicate insulated strings has demonstrated significant reduction in casing temperature can be achieved by changes in joint design. DOE

N81-22460# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Digitale Bildverarbeitung.
COMPARATIVE EXPERIMENTAL STUDY ON THE USE OF ORIGINAL AND COMPRESSED MULTISPECTRAL LANDSAT DATA FOR APPLIED RESEARCH
Klaus A. Ulbricht Feb. 1980 82 p refs Original contains color illustrations
(DFVLR-FB-80-03) Avail: NTIS HC A05/MF A01

The LANDSAT images of the Bayuda desert in Sudan and the Baltic Sea were submitted to supervised maximum likelihood classification. Partitioning of classified images is given on a percentage basis as a function of sigma. Three dimensional clusters of spectral channels and histograms show the influence of compression. After classification the substance in its compressed state has a higher or lower share of the total area than the original substance, depending on the training area. For all sigma values applied, the compressed classification percentages within one substance either stay totally above or totally below original percentages. Author (ESA)

N81-22461# Environmental Monitoring and Support Lab., Las Vegas, Nev. Office of Research and Development.
MODIFICATIONS OF MODELS PREDICTING TROPHIC STATE OF LAKES: ADJUSTMENT OF MODELS TO ACCOUNT FOR THE BIOLOGICAL MANIFESTATIONS OF NUTRIENTS Final Report
S. C. Hern, V. W. Lambou, L. R. Williams, and W. D. Taylor Jan. 1981 49 p refs
(PB81-144362; EPA-600/3-81-001) Avail: NTIS HC A03/MF A01 CSCL 08H

The strong relationship between total phosphorus and phytoplankton biomass in lakes is clearly confirmed. A quantitative understanding of the range in biomass (as measured by chlorophyll a) per unit of phosphorus which extends over order of magnitude is needed. Data collected from lakes were analyzed determining the environmental facts effecting the response of phytoplankton chlorophyll a to total phosphorus. It was found that light attenuation from other than nonchlorophyll a related interferences can dramatically affect the quantity of phytoplankton biomass in many U.S. Lakes. GRA

N81-22462# Tosco Research, Inc., Denver, Colo.
DETERMINATION OF IN SITU HORIZONTAL ROCK STRESS ON BOTH A MINE-WIDE AND DISTRICT-WIDE BASIS Final Report, Oct. 1978 - Feb. 1980
Jose F. T. Agapito (Agapito (Jose F. T.) and Associates), Scott J. Mitchell, Michael P. Hardy, and William N. Hoskins 1 Mar. 1980 175 p refs
(Contract DI-BM-J0-285020)
(PB81-139735; BM-OFR-143-80) Avail: NTIS HC A08/MF A01 CSCL 08I

Because several underground coal mines currently operating in the Beckley district of West Virginia are experiencing serious roof and floor problems, a significant portion of the estimated 2 billion tons of coal resources may be lost. Using the Bureau of Mine's strain relief overcoring technique, 14 overcoring sites in five mines were drilled producing 53 data sets. Data analysis provided in situ horizontal stresses for each of the five mines and for the district as a whole. Stress data indicate horizontal stresses far in excess of that predicted by theory and in some cases, up to six times the estimated vertical stress. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-22463* National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 28
Jan. 1981 467 p
(NASA-SP-7043(28)) Avail: NTIS HC $15.00 CSCL 10B

This bibliography lists 1610 reports, articles, and other documents introduced into the NASA scientific and technical information system from October 1, 1980 through December 31, 1980. A.R.H.

N81-22464 Houston Univ., Tex.
THE RELATIONSHIP OF MICROSTRUCTURE AND DEGRADATION EFFECTS ON THE OPTICAL PROPERTIES OF THE SELECTIVE SOLAR ABSORBER BLACK CHROME Ph.D. Thesis
Gerald Walter Zajac 1980 134 p
Avail: Univ. Microfilms Order No. 8106910

The microstructural and thermally induced changes were characterized by Auger Electron Spectroscopy (A.E.S.) X-ray Photoelectron Spectroscopy (X.P.S.), Secondary Ion Mass Spectrometery (S.I.M.S.), Thermal Desorption Spectroscopy (T.D.S.), X-ray diffraction, Scanning Electron Microscopy (S.E.M.) and d.c. resistivity measurements. A model was developed which relates the experimentally determined microstructure to the optical properties of the composite system and agrees well with the observed optical degradation. The optical absorption is found to be due to a finely divided densely packed chromium crystallite structure. The optical degradation is discerned to be a two step process. The first phase, the reduction of the deposited hydroxides resulting in decreased emittance of the composite, occurs at low temperatures, the second phase, the higher temperature oxidation of the finally divided metallic chromium, results in considerable loss of solar absorptance. Dissert. Abstr.

N81-22465# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
PHOTOVOLTAIC CONCENTRATOR ARRAY PRODUCTION STUDY. VOLUME 1: STUDY SUMMARY Final Report, 25 Jan. 1979 - 24 Jan. 1980
R. C. Hodge Jan. 1981 30 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-7055/1) Avail: NTIS HC A02/MF A01

The latest and projected concentrator photovoltaic designs were defined and analyzed in terms of their performance and energy cost potentials. The major hardware areas of interest were the basic concentrator modules to include concentrator optics and solar cell receiver assemblies. Both reflective and refractive optics were investigated as well as linear and point-focus cell receivers. Performance was assessed at the individual concentrator module and array levels. Power conditioning and field distribution factors were not addressed. Detailed optimizations were performed to identify production-oriented hardware designs. Resultant energy costs were then estimated at the factory and installed array levels. Results and conclusions are presented. DOE

N81-22466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED INORGANIC SEPARATORS FOR ALKALINE BATTERIES AND METHOD OF MAKING SAME Patent Application
Dean W. Sheibley, inventor (to NASA) Filed 27 Feb. 1981 18 p
(NASA-Case-LEW-13171-1; US-Patent-Appl-SN-238790) Avail: NTIS HC A02/MF A01 CSCL 10C

A method of forming a flexible, porous battery separator comprising a coating applied to a porous, flexible substrate is discussed. The coating comprises: (1) a thermoplastic rubber based resin which is insoluble and unreactive in the alkaline electrolyte; (2) a polar organic plasticizer which is reactive with the alkaline electrolyte to produce a reaction product which contains a hydroxyl group and/or a carboxylic acid group; and (3) a mixture of polar particulate filler materials which are unreactive with the electrolyte. The mixture comprises at least one first filler material, wherein the volume of the mixture of filler materials is less than 45% of the total volume of the fillers and the binder, the filler surface area per gram of binder is about 20 to 60 sq m/gr, and the amount of plasticizer is sufficient to coat each filler particle. NASA

N81-22467*# Thermo Electron Corp., Waltham, Mass.
THERMAL ENERGY STORAGE FOR THE STIRLING ENGINE POWERED AUTOMOBILE Final Report
Dean T. Morgan, ed. Mar. 1979 319 p refs Prepared for Argonne National Lab.
(NASA Order C-2325; Contract W-31-109-38-4135)
(NASA-CR-159561; ANL-K78-4135-1; TE5484-66-79) Avail: NTIS HC A14/MF A01 CSCL 10C

A thermal energy storage (TES) system developed for use with the Stirling engine as an automotive power system has gravimetric and volumetric storage densities which are competitive with electric battery storage systems, meets all operational requirements for a practical vehicle, and can be packaged in compact sized automobiles with minimum impact on passenger and freight volume. The TES/Stirling system is the only storage approach for direct use of combustion heat from fuel sources not suitable for direct transport and use on the vehicle. The particular concept described is also useful for a dual mode TES/liquid fuel system in which the TES (recharged from an external energy source) is used for short duration trips (approximately 10 miles or less) and liquid fuel carried on board the vehicle used for long duration trips. The dual mode approach offers the potential of 50 percent savings in the consumption of premium liquid fuels for automotive propulsion in the United States. A.R.H.

N81-22468# Hittman Associates, Inc., Columbia, Md.
LIFE-CYCLE ENERGY ANALYSES OF ELECTRIC VEHICLE STORAGE BATTERIES Final Report
Daniel Sullivan, Terence Morse, Pragna Patel, Subhash Patel, Joseph Bondar, and Larry Taylor Dec. 1980 291 p refs
(Contract DE-AC02-79ET-25420)
(DOE/ET-25420/T1; H-1008/001-80-964) Avail: NTIS HC A13/MF A01

Nickel-zinc, lead-acid, nickel-iron, zinc-chlorine, sodium-sulfur (glass electrolyte), sodium-sulfur (ceramic electrolyte), lithium-metal sulfide, and aluminum-air batteries were studied in order to evaluate the energy used to produce the raw materials and to manufacture the battery, the energy consumed by the battery during its operational life, and the energy that could be saved from the recycling of battery materials into new raw materials. The value of the life cycle analysis approach is that it includes the various penalties and credits associated with battery production and recycling, which enables a more accurate determination of the system's ability to reduce the consumption of scarce fuels. Battery component materials, the energy requirements for battery production, and credits for recycling are described. The operational energy for an electric vehicle and the procedures used to determine it are discussed. DOE

N81-22469*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY (EXHIBIT D). VOLUME 5: SYSTEMS ENGINEERING/INTEGRATION RESEARCH AND TECHNOLOGY Final Report
G. M. Hanley Washington NASA Mar. 1981 216 p refs 7 Vol.
(Contract NAS8-32475)
(NASA-CR-3396; SSD-80-0108-5) Avail: NTIS HC A10/MF A01 CSCL 10A

Guidelines and ground rules followed in the development of requirements for the SPS are presented. Development planning objectives are specified in each of these areas, and evolutionary SPS program scenarios are described for the various concepts studied during the past one year contract. Program descriptions are presented as planning packages of technical tasks, and schedule phasing. Each package identifies the ground based technology effort that will facilitate SPS definitions, designs, development, and operations. T.M.

N81-22470# Argonne National Lab., Ill. Energy and Environmental Systems Div.
SOLAR RELIABILITY AND MATERIALS LIBRARY. VOLUME 2: USER'S MANUAL
H. Singh, R. M. Wolosewicz, and I. Singh (ECA, Inc.) Sep. 1980 131 p refs 2 Vol.
(Contract W-31-109-eng-38)
(ANL/EES-TM-115-Vol-2) Avail: NTIS HC A07/MF A01

This user's manual is the second of two volumes documenting the solar reliability and materials program library at Argonne National Laboratory. This volume describes the data card formats, identification codes, and dictionaries used in recording data and compiling reliability statistics on solar energy systems structured around the solar heating and cooling system demonstration sites sponsored by the Department of Energy. Sufficient flexibility was

built into the coding plan to expand the library to include other solar energy systems. As with any reliability library, the structure will change with time and the needs of the solar energy community. As changes in structure occur, updated editions of the user's manual will be issued to incorporate them. Some of the programs that were developed using the Statistical Analysis System (SAS) processor are presented to indicate the steps to be followed in linking the various SAS procedures into a production algorithm. Because SAS is a versatile system, other programs and outputs can be generated. DOE

N81-22471*# Wilson-Hill Associates, Inc., Washington, D.C.
SOLAR SPACE AND WATER HEATING SYSTEM INSTALLED AT CHARLOTTESVILLE, VIRGINIA Final Report
Sep. 1980 100 p
(Contract EG-77-A-01-4095)
(NASA-CR-161675) Avail: NTIS HC A05/MF A01 CSCL 10A

The solar energy system located at David C. Wilson Neuropsychiatric Hospital, Charlottesville, Virginia, is described. The solar energy system consists of 88 single glazed, Sunworks 'Solector' copper base plate collector modules, hot water coils in the hot air ducts, a Domestic Hot Water (DHW) preheat tank, a 3,000 gallon concrete urethane insulated storage tank and other miscellaneous components. Extracts from the site files, specifications, drawings, installation, operation and maintenance instructions are included. S.F.

N81-22472*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF UPWIND AND DOWNWIND ROTOR OPERATIONS OF THE DOE/NASA 100-kW MOD-0 WIND TURBINE
John C. Glasgow, Dean R. Miller, and Robert D. Corrigan 1981 12 p refs Presented at the 2nd DOE/NASA Wind Turbine Dyn. Workshop, Cleveland, 24-26 Feb. 1981
(NASA-TM-81744; E-798; DOE/NASA1028-31) Avail: NTIS HC A02/MF A01 CSCL 10B

Three aspects of the test results are compared: rotor blade bending loads, rotor teeter response, and nacelle yaw moments. As a result of the tests, it is shown that while mean flatwise bending moments were unaffected by the placement of the rotor, cyclic flatwise bending tended to increase with wind speed for the downwind rotor while remaining somewhat uniform with wind speed for the upwind rotor, reflecting the effects of increased flow disturbance for a downwind rotor. Rotor teeter response was not significantly affected by the rotor location relative to the tower, but appears to reflect reduced teeter stability near rated wind speed for both configurations. Teeter stability appears to return above wind speed, however. Nacelle yaw moments are higher for the upwind rotor but do not indicate significant design problems for either configuration. T.M.

N81-22473*# Institute of Gas Technology, Chicago, Ill. Engineering Research Div.
STABILIZING PLATINUM IN PHOSPHORIC ACID FUEL CELLS Quarterly Report, Dec. 1980 - Mar. 1981
Robert J. Remick Apr. 1981 25 p refs
(Contracts DEN3-208; DE-AI01-80ET-17088)
(NASA-CR-165311; DOE/NASA/0208-1; Rept-61051; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

The cathode of the phosphoric acid fuel cell uses a high surface area platinum catalyst supported on a carbon substrate. During operation, the small platinum crystallites sinter, causing loss in cell performance. A support was developed that stabilizes platinum in the high surface area condition by retarding or preventing the sintering process. The approach is to form etch pits in the carbon by oxidizing the carbon in the presence of a metal oxide catalyst, remove the metal oxide by an acid wash, and then deposit platinum in these pits. Results confirm the formation of etch pits in each of the three supports chosen for investigation: Vulcan XC-72R, Vulcan XC-72 that was graphized at 2500 C, and Shawinigan Acetylene Black. T.M.

N81-22474*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY ABSORPTION CHARACTERISTICS AND THE EFFECTS OF HEAT ON THE OPTICAL PROPERTIES OF SEVERAL COATINGS
J. R. Lowery Apr. 1981 14 p refs
(NASA-TM-82414) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar energy absorption characteristics of several high temperature coatings were determined and effects of heat on these coatings were evaluated. Included in the investigation were an electroplated alloy of black chrome and vanadium, electroplated black chrome, and chemically colored 316 stainless steel. Each of the coatings possessed good selective solar energy absorption properties at laboratory ambient temperature. Measured at a temperature of 700 K (800 F), the emittances of black chrome, black chrome vanadium, and colored stainless steel were 0.11, 0.61, and 0.15, respectively. Black chrome and black chrome vanadium did not degrade optically in the presence of high heat (811 K (1000 F)). Chemically colored stainless steel showed slight optical degradation when exposed to moderately high heat (616 K (650 F)0, but showed more severe degradation at exposure temperatures beyond this level. Each of the coatings showed good corrosion resistance to a salt spray environment. Author

N81-22475*# Energy Research Corp., Danbury, Conn.
TECHNOLOGY DEVELOPMENT FOR PHOSPHORIC ACID FUEL CELL POWERPLANT (PHASE 2) Quarterly Report
Larry Christner Jun. 1980 49 p refs
(Contract DEN3-67; DE-AI03-79ET-11272)
(NASA-CR-165318; DOE/NASA/0067-79-6; QR-7) Avail: NTIS HC A03/MF A01 CSCL 10A

Progress is reported in the development of material, cell components, and reformers for on site integrated energy systems. Internal resistance and contact resistance were improved. Dissolved gases (O2, N2, and CO2) were found to have no effect on the electrochemical corrosion of phenolic composites. Stack performance was increased by 100 mV over the average 1979 level. A.R.H.

N81-22476*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE CALCULATIONS FOR 200-1000 MWe MHD/STEAM POWER PLANTS
Peter J. Staiger 1981 11 p refs Presented at the Nineteenth Symp. on the Eng. Aspects of Magnetohydrodyn., Tullahoma, Tenn., 15-17 Jun. 1981
(NASA-TM-81775; DOE/NASA/10769-16; E-836) Avail: NTIS HC A02/MF A01 CSCL 10B

The effects of MHD generator length, level of oxygen enrichment, and oxygen production power on the performance of MHD/steam power plants ranging from 200 to 1000 MW in electrical output are investigated. The plants considered use oxygen enriched combustion air preheated to 1100 F. Both plants in which the MHD generator is cooled with low temperature and pressure boiler feedwater and plants in which the generator is cooled with high temperature and pressure boiler feedwater are considered. For plants using low temperature boiler feedwater for generator cooling the maximum thermodynamic efficiency is obtained with shorter generators and a lower level of oxygen enrichment compared to plants using high temperature boiler feedwater for generator cooling. The generator length at which the maximum plant efficiency occurs increases with power plant size for plants with a generator cooled by low temperature feedwater. Also shown is the relationship of the magnet stored energy requirement of the generator length and the power plant performance. Possible cost/performance tradeoffs between magnet cost and plant performance are indicated. Author

N81-22477*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVIEW OF STAND-ALONE PHOTOVOLTAIC APPLICATION PROJECTS SPONSORED BY US DOE AND US AID
William J. Bifano 1981 12 p refs Presented at the Ann. Conf. of the Am. Sect. of the Intern. Solar Energy Soc., Inc., Philadelphia, 26-30 May 1981
(Contract DE-AI01-79ET-20485)
(NASA-TM-81738; DOE/NASA/20485-8; E-809) Avail: NTIS HC A02/MF A01 CSCL 10A

Experience with dc photovoltaic systems (without backup power) and ranging in output from 23 to 3,500 peak watts, in a wide range of environmental conditions and with a wide range

of insolation, is described. Cooperation of NASA with other government agencies resulted in the installation of an air pollution monitor in New Jersey, a seismic sensor in Hawaii, power for lookout towers in national forests in California, an electric power system for a Papago Indian village in Arizona, and a power system for a grain mill and water pump in Tangaye, Upper Volta. Significant operational results are discussed and system reliability is assessed for the 20 experimental systems installed since 1976. Additional systems to be installed overseas are highlighted, and economic factors are considered. A.R.H.

N81-22478*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN EXPERIMENTAL INVESTIGATION OF SILICON WAFER SURFACE ROUGHNESS AND ITS EFFECT ON THE FULL STRENGTH OF PLATED METALS

Guy D. Spiers 1981 8 p refs Presented at the 15th Photovoltaic Specialists Conf., Kissimmee, Fla., 12-15 May 1981

(NASA-TM-81763; E-826) Avail: NTIS HC A02/MF A01 CSCL 10A

Plated silicon wafers with surface roughness ranging from 0.4 to 130 microinches were subjected to tensile pull strength tests. Electroless Ni/electroless Cu/electroplated Cu and electroless Ni/electroplated Cu were the two types of plate contacts tested. It was found that smoother surfaces had higher pull strength than rougher, chemically etched surfaces. The presence of the electroless Cu layer was found to be important to adhesion. The mode of fracture of the contact as it left the silicon was studied, and it was found that in almost all cases separation was due to fracture of the bulk silicon phase. The correlation between surface roughness and mode of contact failure is presented and interpreted. Author

N81-22479 National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.

QUANTITATIVE CONSIDERATIONS CONCERNING A HIGH PERFORMANCE HEAT PIPE WITH A SHORT ELECTRO-OSMOTIC PUMPING SECTION

A. A. M. Delil 29 Oct. 1979 50 p refs

(Contract NIVR-1833)

(NLR-TR-79113-L) Avail: Issuing Activity

Electro-osmotic pumping restricted to a short fine pore section connected in series with a normal wider pored wick with low flow resistance was studied theoretically. A heat pipe with a fully controllable heat transport capacity is thus available. A practical case was considered in which a dilute CO2 water solution is used as a working fluid. The zero voltage performance and electro-osmotic figure of merit parameters are defined. Zero gravity and terrestrial gravity condition examples are treated. Author (ESA)

N81-22480# Coast Guard Research and Development Center, Groton, Conn.

EVALUATION OF SOLAR PHOTOVOLTAIC ENERGY STORAGE FOR AIDS TO NAVIGATION Interim Report

W. R. Allen, J. S. Ryba, and S. E. Trenchard Nov. 1980 71 p refs

(AD-A096476; CGR/DC-12/80; USCG-D-5-81) Avail: NTIS HC A04/MF A01 CSCL 10/3

A detailed discussion of the U.S. Coast Guard aids to navigation application of solar photovoltaics with an emphasis on energy storage by lead-acid batteries is presented. A methodology is developed for the prediction of performance of a lead-acid battery in low-rate photovoltaic charging. Experimental results from five years of solar photovoltaic charging of lead-antimony grid batteries at various levels of voltage regulation are discussed. A two-level, two-factorial experiment with pure-lead grid batteries is analyzed. An experimental comparison is made between pure-lead grid and lead-calcium grid batteries. The results of temperature-controlled zener diode voltage regulator testing are presented. All three grid types of lead-acid batteries were found to be acceptable for aids to navigation usage with different constraints on voltage regulation and maintenance needed for each type. A final discussion is presented on the considerations for the operational deployment of solar photovoltaic-powered aids to navigation. GRA

N81-22481# Illinois Univ. at Urbana. Dept. of Mechanical and Industrial Engineering.

AN INVESTIGATION OF INSTANTANEOUS HEAT TRANSFER RATES IN THE EXHAUST PORT OF AN INTERNAL COMBUSTION ENGINE Final Report

Rakesh Sachdev and S. C. Sorenson Jan. 1981 120 p refs (Grants DAAG29-78-G-0133; DAAG29-76-G-0265)

(AD-A096756; UILU-ENG-80-4008; ARO-13876.1-EX) Avail: NTIS HC A06/MF A01 CSCL 21/7

Recently, the growing concern over the exhaust emissions, cooling requirements and design of exhaust system devices has led to the study of the instantaneous heat transfer rates in the straight portion of the engine exhaust port and the port itself. In this study, experimental measurements were made of the instantaneous exhaust gas temperatures and the instantaneous wall surface temperatures at four different positions in the exhaust port for a range of engine operating conditions. The calculated instantaneous heat transfer rates and the instantaneous heat transfer coefficients were found to be significantly dependent on the geometrical position in the exhaust port, the engine speed and the engine load and depicted a consistent trend in the results. GRA

N81-22482# Oklahoma State Univ., Stillwater. Div. of Engineering.

CHARACTERIZATION OF HEAT TRANSFER IN CERAMIC COATED INTERNAL COMBUSTION ENGINES Final Report, 1 Jan. 1979 - 31 Dec. 1980

Richard G. Murray and Neil E. Hoecker 15 Feb. 1981 129 p refs

(Grant DAAG29-79-G-0021)

(AD-A096762; ARO-15789.2-E; FR-1) Avail: NTIS HC A07/MF A01 CSCL 21/7

The following document is a final report for Grant Number DAAG29-79-G-0021 funded by the U.S. Army Research Office. This project was started 1 January 1979 and had a duration of two years. In general, the project was: (1) to develop a mathematical model describing heat transfer and temperature characteristics in ceramic coated engine components, (2) to measure operational temperatures for such parts with various coating thickness, and (3) to continue a previous endurance test of ceramic parts. GRA

N81-22483# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.

DEVELOPMENT OF HIGH-EFFICIENCY STACKED MULTIPLE-BANDGAP SOLAR CELLS Interim Technical Report, 1 Aug. 1978 - 1 Oct. 1979

R. P. Ruth, J. S. Harris, F. D. Dapkus, R. D. Dupuis, and S. W. Zehr Wright-Patterson AFB, Ohio AFWAL Oct. 1980 177 p refs

(AD-A096764; C78-1225.28/501; AFWAL-TR-80-2096) Avail: NTIS HC A09/MF A01 CSCL 10/2

The first 14 month program of a twenty-four month experimental investigation backed by analytical modeling has been conducted to develop technologies required for fabricating stacked multiple bandgap solar cell (SMBSC) assemblies having AMO 1-sun efficiencies of 25% or greater at 25 C. Investigations were undertaken with the following four SMBSC materials systems: (1) two-cell GaAs-Ge structure, made by metalorganic chemical vapor deposition (MO-CVD), conventional CVD, and molecular-beam epitaxy (MBE) methods; (2) two-cell GaAs-InGaAs structure, made by liquid-phase epitaxy (LPE) techniques; (3) three-cell GaAlAs-GaAs-GaAsSb structure, made by MO-CVD and MBE methods; and (4) three-cell GaAlAs-GaAs-InGaAsP structure, made by LPE and MBE methods. Each of these systems involves the GaAlAs-GaAs materials combination as the basic building block. Near the end of the program a change in emphasis was introduced to limit the investigations to GaAlAs-GaAs and GaAs-Ge two-cell structures and the three-cell GaAlAs-GaAs-Ge structure that might also result. Principal emphasis was then placed on the MO-CVD technique, supplemented by MBE, LPE, or other deposition and/or processing techniques where appropriate. The principal achievement was with the GaAlAs-GaAs system, in which a two-cell SMBSC that exhibited voltage addition (Voc approx = 2.1 V) under illumination was successfully fabricated. The two individual cells and the connecting tunnel junction were grown entirely by MO-CVD techniques in this structure. Similar

structures made by a combination of MO-CVD and MBE techniques also appeared quite promising. GRA

N81-22484# Schumacher (J. C.) Co., Oceanside, Calif.
LOW-COST SILICON PROCESS DEVELOPMENT. PHASE 4: PROCESS IMPROVEMENT Quarterly Technical Progress Report
E. Moore and C. Newman Jan. 1981 18 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-9279-1-T1; QTPR-1) Avail: NTIS HC A02/MF A01

Three project tasks include process improvement studies, kinetic studies, and process economic studies. Process improvement studies in a miniplant focused on the correlation of current miniplant yield results with prior laboratory scale work. The silicon product reactor was operated in the thermal disproportionation mode and successfully processed 35 kilograms of tribromosilane. The yield during the test ranged from 75 to 85% of theoretical. The experimental apparatus for use in the determination of the decomposition rate of tribromosilane was assembled, tested and placed into service. The computer code, REPORT, for plant daily operations data keeping is given. DOE

N81-22485# GTE Sylvania, Inc., Towanda, Pa.
CERAMIC HEAT RECUPERATORS FOR INDUSTRIAL HEAT RECOVERY Final Report
Joseph J. Cleveland, Jeffrey M. Gonzalez, Kent H. Kohnken, and Wilfred J. Rebello (PAR Enterprises, Inc., Fairfax, Va.) Aug. 1980 183 p refs
(Contracts DE-AC01-76CS-40174; EX-76-C-01-2162)
(DOE/CS-40174/T2) Avail: NTIS HC A09/MF A01

A cordierite (magnesium aluminum silicate) recuperator was designed for relatively small furnaces with firing rates of 0.3 MM to 0.6 MM Btu/h and with exhaust gas temperatures of 1500 F to 2600 F. Five demonstration programs were performed to determine the heat transfer performance of the device, establish the energy savings by recovery, demonstrate the durability of the ceramic core, determine the operating requirements of the burners and controls with recuperation, and establish the overall system costs and payback period. The recuperator is described and results of tests and measurements, system economics, and cost performance analyses are presented. The methodology is developed and techniques for impact analysis are described. Industrial applications are implied and a process flow diagram for smelting and refining primary copper is shown. DOE

N81-22486# Martin Marietta Aerospace, Denver, Colo.
SOLCOST-PASSIVE SOLAR ENERGY DESIGN PROGRAM: USERS GUIDE
Sep. 1980 69 p
(Contract DE-AC02-76ET-20102)
(DOE/ET-20102/T1) Avail: NTIS HC A04/MF A01

The SOLCOST-PASSIVE solar energy design program is a public domain interactive computer design tool intended for use by non-thermal specialists to size passive solar systems with a methodology based on the Los Alamos Solar Load Ratio (SLR) method. A life cycle savings analysis is included. An overview of SOLCOST-PASSIVE capabilities and the Solar Load Ratio method which it is based on is presented. A detailed guide to the SOLCOST-PASSIVE input parameters is given. Sample problems showing typical execution sessions and the resulting SOLCOST-PASSIVE output are included. Appendices A thru D provide details on the SLR method and the life cycle savings methodology of SOLCOST-PASSIVE. DOE

N81-22487# Martin Marietta Aerospace, Denver, Colo.
SOLCOST-PHOTOVOLTAIC SOLAR ENERGY DESIGN PROGRAM: USERS GUIDE
Oct. 1980 65 p refs
(Contract DE-AC02-76ET-20108)
(DOE/ET-20108/T3) Avail: NTIS HC A04/MF A01

The SOLCOST-PHOTOVOLTAIC (PV) solar energy design program is a public domain interactive computer design tool intended for use by non-solar specialists to predict the long term performance for photovoltaic systems. A life cycle cost analysis is included along with an economic analysis which predicts energy costs for the photovoltaic system assuming ownership by an electric utility. SOLCOST-PV currently can evaluate flat plate arrays and concentrating arrays which use Fresnel lenses and passive cooling. An overview of the SOLCOST-PV capabilities and methodology is given. A detailed guide to the SOLCOST-PV input parameters is included, and examples showing typical interactive execution sessions and the resulting SOLCOST-PV output are presented. Appendices A and B provide additional information on the SOLCOST-PV analysis. DOE

N81-22488# Hayward Community Schools, Wis.
SOLAR HEATING DEMONSTRATION Final Report
Lee Bonicatto and Carl Kozak 1980 5 p
(Contract DE-FG02-79R5-10164)
(DOE/R5-10164/2) Avail: NTIS HC A02/MF A01

The demonstration involved a 4 panel solar collector mounted on the industrial arts building. A 120 gallon storage tank supplements a 66 gallon electric hot water heater which supplies hot water for 5 shop wash basins, girl's and boy's lavatories, and a pressure washer in the auto shop. The installation and educational uses of the system are described. DOE

N81-22489# Argonne National Lab., Ill. Chemical Engineering Div.
ADVANCED FUEL CELL DEVELOPMENT Progress Report, Apr. - Jun. 1980
R. D. Pierce, R. M. Arons, J. T. Dusek, A. V. Fraioli, G. H. Kucera, R. B. Poeppel, J. W. Sim, and J. L. Smith Nov. 1980 27 p refs
(Contract W-31-109-eng-38)
(ANL-80-98) Avail: NTIS HC A03/MF A01

Advanced fuel cell research and development activities are described. Efforts were directed toward understanding and improving components of molten carbonate fuel cells and included operation of a 10 cm square cell. Studies continued on the development of electrolyte structures (LiAlO2 and Li2CO3-K2CO3). Preparation of sintered LiAlO2 as electrolyte support is described. Tape casting is presently under investigation as a method for producing green bodies to be sintered; this technique may be an improvement over cold pressing. The transition temperature for the (ALPHA) to (BETA) LiAlO2 allotropic transformation is determined using differential thermal analysis. Electroless nickel plating is investigated as a means of providing corrosion protection to structural hardware. DOE

N81-22490# Bendix Corp., Kansas City, Mo.
MULTIPLEXED PROPORTIONAL TEMPERATURE CONTROL
J. R. Lembke Feb. 1981 10 p ref
(Contract DE-AC04-76DP-00613)
(BDX-613-2570) Avail: NTIS HC A02/MF A01

A precision temperature control for an electrodeposition tank maintenance system was developed. The technique uses a bridge circuit to compare the resistance of a temperature sensing thermistor to an adjustable resistance. A multiplexer samples several voltage comparators and triggers solid-state relays to control application of power to tank heaters. DOE

N81-22491# Public Service Co. of New Mexico, Albuquerque.
COMMERCIAL SOLAR/LOAD MANAGEMENT EXPERIMENT: NEW MECHANICAL ENGINEERING BUILDING Interim Report, period ending Jul. 1980
J. M. Noble Jan. 1981 35 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 844-2)
(EPRI-EM-1680) Avail: NTIS HC A03/MF A01

The effects of load management heat recovery, thermal storage, and solar systems on energy usage and power demand profiles in the University of New Mexico's Mechanical Engineering Building are presented. Results were obtained from a year monitoring of the building's heating and cooling systems and recording of sensor signals by a computer based data acquisition system. A modified AXCESS Energy Analysis Program to simulate energy usage is detailed, and the development of perferred strategies for maximizing the building's load management capabilities is outlined. DOE

N81-22492# Department of Natural Resources, Baton Rouge, La.

OPERATIONS RESEARCH AND SYSTEMS ANALYSIS OF GEOPRESSURED-GEOTHERMAL ENERGY IN LOUISIANA Final Report, 1 Jun. 1978 - 31 Aug. 1979
Adrain E. Johnson, Jr. Nov. 1980 295 p
(Contracts DE-FG08-78ET-27085; ET-78-C-08-1576)
(DOE/ET-27085/1) Avail: NTIS HC A13/MF A01

A projection of the probable contribution of the geopressured-geothermal energy resource in Louisiana is compared to the overall energy requirements of the nation. Objectives were: development of the tools and methodology for performing economic analyses; application of these tools to specific prospects about which adequate resource assessments were made; identification of the impediments to resource development; and socio-economic analysis of the impact of development of the resource on these specific prospects. An overview of the geopressured-geothermal resource activities in Louisiana is provided. Major conclusions and findings with respect to commercial viability, impediments, and social and economic impact are presented, and recommendations made for future systems analysis. DOE

N81-22493# Decision Planning Corp., Costa Mesa, Calif.
PASSIVE AND HYBRID SOLAR ENERGY PROGRAM
Nov. 1980 310 p
(Contracts DE-AT02-77CH-99002; EW-78-C-02-4970)
(DOE/CS-4970/1) Avail: NTIS HC A14/MF A01

The background and scope of the program is presented in general terms. The program plan is summarized describing how individual projects are categorized into mission oriented tasks according to market sector categories. The individual projects funded by DOE are presented as follows: residential buildings, commercial buildings, solar products, solar cities and towns, and agricultural buildings. A summary list of projects by institution (contractors) and indexed by market application area is included. DOE

N81-22494# Churchill (Joe) Construction, Inc., Macomb, Ill.
LOW INFILTRATION-HIGH INSULATION HOUSE CONSTRUCTION Final Report
Joe Churchill 24 Nov. 1980 11 p
(Grant DE-FG02-79R5-10111)
(DOE/R5-10111/1) Avail: NTIS HC A02/MF A01

The 1440 square foot, single family house features innovative construction techniques using standard materials. Special double thick and double insulated walls were built. The ceiling was specially built and crawl space was insulated heavily and the band joist assembly was redesigned so as to eliminate the band joist and sill plate completely. These details are represented. Records were kept on energy consumption of the electric heat system, the water heater, and the air conditioner, and data on these are presented. DOE

N81-22495# Research for Growth and Transfer, Inc., Houston, Tex.
INTEGRATION METHODOLOGY FOR ENERGY SUPPLIES AND DEMANDS Final Report
R. G. Thompson, J. C. Stone, and S. Muthukrishman Nov. 1980 84 p refs
(EPRI Proj. 1149-3)
(EPRI-EA-1633) Avail: NTIS HC A05/MF A01

The objective is to obtain a relatively simple system that can be readily disseminated and used extensively (and inexpensively) to provide forecasts and analysis of future movements in energy prices and quantities. The integration method is built heavily on the long standing economic principles of price theory, blending knowledge of future options and past decisions into conventional supply/demand equations. Operationally, complex models of primary energy supply, energy conversion, and final demand are employed to generate a body of data on energy prices and quantities. DOE

N81-22496# Department of Energy, Washington, D. C. Office of Energy Use Analysis.
RESIDENTIAL ENERGY DEMAND MODELS: CURRENT STATUS AND FUTURE IMPROVEMENTS
Gerald Peabody Dec. 1980 67 p refs
(DOE/EIA-0261) Avail: NTIS HC A04/MF A01

Two models currently used to analyze energy use by the residential sector are described. The ORNL model is used to forecast energy use by fuel type for various end uses on a yearly basis. The MATH/CHRDS model analyzes variations in energy expenditures by households of various socioeconomic and demographic characteristics. The essential features of the ORNL and MATH/CHRDS models are retained in a proposed model and integrated into a framework that is more flexible than either model. The important determinants of energy use by households are reviewed. DOE

N81-22497# Department of Energy, Washington, D. C. Office of Field Operations Management.
CAPSULE REVIEW OF THE DOE RESEARCH AND DEVELOPMENT AND FIELD FACILITIES
Sep. 1980 53 p
(DOE/ER-0092) Avail: NTIS HC A04/MF A01

Descriptions of DOE facilities are given for multiprogram laboratories (12); program dedicated facilities (biomedical and environmental facilities-12, fossil energy facilities-7, fusion energy facility-1, nuclear development facilities-3, physical research facilities-4, safeguards facility-1, and solar facilities-2); and production, testing, and fabrication facilities (nuclear materials production facilities-5, weapon testing and fabrication complex-8). Lists are presented of DOE field and project offices; DOE field facilities by state or territory, names, addresses, and telephone numbers; DOE R and D field facilities by type, contractor names, and names of directors. DOE

N81-22498# Ad-Ex International, Portola Valley, Calif.
STUDIES ON METALLIC ZINC
T. Sakai, M. Kumeda, and N. Nishizawa Dec. 1980 6 p refs Transl. into ENGLISH from a report by Central Research Inst., Sanyo Electric Co., Ltd., Japan Sponsored by DOE Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11656) Avail: NTIS HC A02/MF A01

The fabrication and performance testing of air zinc batteries is described. Both single cells and composite cells were studied. The discharge characteristics obtained are plotted. DOE

N81-22499# California Univ., Berkeley. Energy and Environment Div.
FORECASTING THE ROLE OF RENEWABLES IN HAWAII
Jayant Sathaye and Henry Ruderman Nov. 1980 33 p refs Presented at the Intern. Assoc. of Energy Economists, Washington, D.C., 5-7 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11903; CONF-8010152-1) Avail: NTIS HC A03/MF A01

Alternative future energy supply systems for Hawaii were investigated. Other elements of the study examined future demand for energy, what indigeneous resources are available, what technologies will be sufficiently developed to exploit them, and what will be their social, economic, and environmental consequences. Each of the four counties in the state appear to have sufficient natural resources to supply nearly all of their energy needs. The island is in the belt of the northeast trade winds, has extensive high temperature geothermal resources, enjoys a higher average insolation than the mainland states, and the large temperature gradients and absence of a continental shelf make Hawaii a prime location for OTEC. DOE

N81-22500# Wilson-Hill Associates, Inc., Washington, D.C.
ENERGY EMERGENCY MANAGEMENT INFORMATION SYSTEM (EEMIS): FUNCTIONAL REQUIREMENTS
17 Oct. 1980 48 p
(Contract DE-AC01-80EI-11581)
(DOE/EIA-11581/T1) Avail: NTIS HC A03/MF A01

These guidelines state that in order to create the widest practicable competition, the system's requirements, with few exceptions, must be expressed in functional terms without reference to specific hardware or software products, and that wherever exceptions are made a statement of justification must be provided. In addition, these guidelines set forth a recommended maximum threshold limit of annual contract value for schedule contract procurements. DOE

N81-22501# Meyer (A. F.) and Associates, Inc., McLean, Va.
SAFETY ANALYSIS AND REVIEW SYSTEM FOR THE

DEPARTMENT OF ENERGY'S FOSSIL ENERGY PROGRAMS, PHASE 1 Quarterly Repprt
Ellen T. Browne Dec. 1980 14 p
(Contract DE-AM01-80ET-13650)
(DOE/ET-13650/1) Avail: NTIS HC A02/MF A01

Work performed to data by A.F. Meyer and Associates, Inc. (AFMA) in support of SARS implementation is summarized. Under the contract, AFMA is providing technical assistance to DOE to analyze SARS data and develop recommended milestones for the Headquarters review requirements, analyze and recommend alternative procedures for conduct of such reviews and develop costs thereon; and support such Headquarters reviews and evaluate SARS activities at project and field analysis and review levels. DOE

N81-22502# Los Alamos Scientific Lab., N. Mex.
WORKSHOPS TO RATE AND ASSIGN AIR AND WATER ISSUES FOR HYDROTHERMAL ENERGY DEVELOPMENT
Joel M. Williams and Eugene M. Wewerka Dec. 1980 59 p refs Conf. held at Los Alamos Scientific Lab., N. Mex., 11-12 Mar. 1980
(Contract W-7405-eng-36)
(LA-8613-C) Avail: NTIS HC A04/MF A01

Environmental issues associated with airborne contaminants include: hydrothermal technology and site selection; pollution sources, characterization and transport; and environmental and health impacts. Issues associated with water and land are presented as well. S.F.

N81-22503# Los Alamos Scientific Lab., N. Mex. Solar Energy Group.
SOLAR ENERGY RESEARCH AT LASL Progress Report, 1 Oct. 1979 - 31 Mar. 1980
Sherry K. Reisfeld, comp. and Donald A. Neeper, comp. 31 Mar. 1980 58 p refs
(LA-8450-PR) Avail: NTIS HC A04/MF A01

The work of Q-11, the Solar Energy Group of the Los Alamos Scientific Laboratory, is documented for October 1979 through March 1980. Q-11 conducted passive solar heating research and collector testing. In addition, the group provided technical support to the Department of Energy, Office of Solar Applications for Buildings, for both solar collector and passive system development. Author

N81-22504# Ames Lab., Iowa.
ADVANCED RESEARCH AND TECHNOLOGY: DIRECT UTILIZATION RECOVERY OF MINERALS FROM COAL FLY ASH. FOSSIL ENERGY PROGRAM Technical Progress Report, 1 Jul. - 30 Sep. 1980
G. Burnet, M. J. Murtha, and D. J. Adelman Dec. 1980 110 p refs
(Contract W-7405-eng-82)
(IS-4760) Avail: NTIS HC A06/MF A01

Methods for utilizing coal fly ash through processes for the extraction of alumina and titania, and for the separation and use of an iron-rich fraction are described. Research of the HiChlor process for the extraction of alumina and titania by high temperature chlorination of a fly ash reductant mixture is described. An engineering cost evaluation is presented for a centralized HiChlor processing facility to process the fly ash of several large coal fueled power stations. Investigations for a high temperature lime soda process for extraction of alumina from fly ash included the use of several types of quarry limestones and waste materials to replace the limestone and/or soda ash. DOE

N81-22505# Arizona Univ., Tucson. Office of Arid Lands Studies.
FEASIBILITY OF USING RUSSIAN THISTLE SALSOLA KALI L. FOR BIOCONVERSION Quarterly Report, 1 Aug. - 31 Oct. 1980
Martin M. Karpiscak, R. Leslie Rawles, Kenneth E. Foster, Aden B. Meinel, and Marjorie P. Meindel Nov. 1980 13 p refs
(Grant DE-FG03-79SF-10550)
(DOE/SF-10550/T1; QR-5) Avail: NTIS HC A02/MF A01

Studies of seed viability are described. The germination and plant growth for Russian thistle (tumbleweed) are emphasized. DOE

N81-22506# Massachusetts Inst. of Tech., Cambridge.
PHOTOCHEMICAL ENERGY STORAGE: STUDIES OF INORGANIC PHOTOASSISTANCE AGENTS Progress Report, 17 Dec. 1979 - 31 Mar. 1981
Mark S. Wrighton Dec. 1980 31 p refs
(Contract DE-AS02-76ER-04178)
(DOE/ER-04178/4) Avail: NTIS HC A03/MF A01

A number of small band gap p-type semiconductors were demonstrated to have poor H2 evolution kinetics despite the fact that a reasonable output photovoltage (E sub V) compared to E sub g could be expected. Special emphasis was on p-type Si (E sub g = 1.1 eV). Both of these materials give poor kinetics for H2 evolution from H2O. A surface derivatizing reagent from diquarternizing 4,4 bipyridine with 1 bromo 3 trimethyloxysilylpropane can be used to functionalize p-type Si with polymeric quantities of redox reagent. DOE

N81-22507# Johnson Controls, Inc., Milwaukee, Wis.
COMMERCIALIZATION OF A THICK-FILM SOLAR CELL Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1981
G. D. McDonald 1980 18 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-8104-2-T4) Avail: NTIS HC A02/MF A01

The use of screen printing as a technique for producing large area solar cells was evaluated with emphasis on the preparation and improvement in performance of screen printed CdS cells. Thermal gravimetric analysis of the CdS inks used to print CdS films confirm that all the fugitive binders and flux are removed under firing conditions used to prepare the CdS films. Warpage of the Nesatron glass substrates makes their use questionable. Multiple layers of CdS appear to resolve a pin hole problem previously encountered. DOE

N81-22508# Ames Lab., Iowa.
FOSSIL ENERGY Annual Report, 1 Oct. 1979 - 30 Sep. 1980
Dec. 1980 176 p refs
(Contract W-7405-eng-82)
(IS-4757) Avail: NTIS HC A09/MF A01

Of particular interest are the development of leaching procedures in the Ames wet oxidation process for desulfurizing coal and the cleaning and recovery of coal fines by flotation and oil agglomeration. Organic sulfur compounds in coal and the behavior of specific organic sulfur compounds chosen as structural models for the sulfur compounds in coal were studied. DOE

N81-22509# California Univ., Livermore. Lawrence Livermore Lab.
STUDIES OF BRINE CHEMISTRY AND SCALING AT THE SALTON SEA GEOTHERMAL FIELD Final Report, 1977 - 1979
J. E. Harrar Jan. 1981 45 p refs
(Contract W-7405-eng-48)
(UCID-18917) Avail: NTIS HC A03/MF A01

Features of studies related to brine chemistry and scaling are reported. The results of investigations of brine chemistry, the effects of brine acidification and organic additives on the rate of scale formation and scale composition, and the use of other additives for scale control are summarized. High salinity, high silica geothermal brines were studied and it was shown that the silica and sulfide scales formed from these brines could be eliminated by lowering the pH of brine. The following steps were completed: testing of technical chemical solutions to the scaling problem; finding low cost metallic materials that will resist the brine; proving a method for the treatment of spend brine for injection; perfection of chemical measurement techniques. Most environmental issues are addressed and first increments of electrical power are generated. E.A.K.

N81-22510# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
MAKING SOLAR LAWS WORK: A STUDY OF STATE SOLAR ENERGY INCENTIVES. VOLUME 1: EXECUTIVE SUMMARY
J. D. Roessner Nov. 1980 39 p refs
(Contract DE-AC02-77CH-00178)
(SERI/TR-722-583-Vol-1) Avail: NTIS HC A03/MF A01

The results of a research investigation of solar financial and research, demonstration, and development incentive programs in 18 states are summarized. The investigation focuses upon implementation - the organization and administrative processes required to convert a law into a viable program. Results indicate that four conditions are common to successful implementation of both types of incentive programs: the opportunity to use solar energy as a heating source; characteristics of the agency selected to complement the law; involvement of outside groups in program implementation; and the specificity of guidance given to those responsible for implementation. Other conditions specific to the implementation of each type of program are discussed as well as the implications of these findings for state and federal policy makers. DOE

N81-22511# Brookhaven National Lab., Upton, N. Y.
CONDUCTION COOLING: MULTICRATE FASTBUS HARDWARE
D. Makowiecki, W. Sims, R. Larsen, L. Leipuner, W. Morse, T. Rudolf, J. Fuhrmann, S. Blatt (Yale Univ.), M. Campbell (Yale Univ.), H. Kasha (Yale Univ.) et al Nov. 1980 13 p refs Presented at IEEE Nucl. Sci. Symp., Orlando, Fla., 5 Nov. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28664; CONF-801103-48) Avail: NTIS HC A02/MF A01

An approach for cooling nuclear instrumentation modules via heat conduction is described. The simplicity of liquid cooled crates and ease of thermal management with conduction cooled modules are described. While this system was developed primarily for the higher power levels expected with Fastbus electronics, it has many general applications. DOE

N81-22512# Rockwell International Corp., Golden, Colo. Energy Systems Group.
SWECS COST OF ENERGY BASED ON LIFE CYCLE COSTING
W. R. Briggs May 1980 55 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3120/3533/80-13) Avail: NTIS HC A04/MF A01

The Small Wind Energy Conversion Systems (SWECS) sizes considered were 1-2 kW, 8 kW, and 40 kW units. Systems costs were based on an assumed sales of 1000 units of each SWECS per year. The results of the LCC analysis show SWECS cost of energy to be competitive with grid electricity costs of energy over the projected lifetimes of the SWECS depending on competing energy cost at the SWECS location, average wind velocity, and efficiency of utilization of SWECS-generated energy. DOE

N81-22513# Rockwell International Corp., Golden, Colo.
PINSON C2E WIND TURBINE GENERATOR FAILURE ANALYSIS AND CORRECTIVE DESIGN MODIFICATION
M. J. Carr, V. K. Grotsky, and J. Sexton Mar. 1980 26 p refs
(Contract DE-AF04-76DP-03533)
(RFP-3148/3533/80-16) Avail: NTIS HC A03/MF A01

On December 4, 1978 wind speeds at the Rocky Flats Small Wind Systems Test Center reached 42 m/s. Two failures were observed on the Pinson C2E wind turbine generator during a routine inspection of all wind machines following this windstorm. One failure was fatigue cracks which formed on plates welded to the rotor shaft. The second failure was a number of cracks in the skin of all three blades. Although the possibility exists that the high winds of that data contributed to these failures, no conclusive data exist substantiating this theory. In fact, the C2E's feathering mechanism functioned normally during the windstorm, thereby controlling rotor overspeed, a potential cause of damage. DOE

N81-22514# General Electric Co., Schenectady, N. Y. Energy Systems Programs Dept.
ELECTROCYCLONE DEVELOPMENT PROGRAM Quarterly Technical Report, Aug. - Oct. 1980
R. R. Boericke 14 Nov. 1980 18 p refs
(Contract DE-AC01-80ET-17091)
(FE-7091-1) Avail: NTIS HC A02/MF A01

An electrostatically augmented cyclone was developed for a high-efficiency, high-throughput gas cleanup device for pressurized fluidized bed combustion. An 18-in. diameter electrocyclone was tested. DOE

N81-22515# Department of Energy, Washington, D. C. Office of Competition.
UNITED STATES PETROLEUM PIPELINES: AN EMPIRICAL ANALYSIS OF PIPELINE SIZING
Leonard L. Coburn Dec. 1980 482 p
(DOE/PE-0024) Avail: NTIS HC A21/MF A01

The undersizing theory hypothesizes that integrated oil companies have a strong economic incentive to size the petroleum pipelines they own and ship over in a way that means that some of the demand must utilize higher cost alternatives. The DOJ theory posits that excess or monopoly profits are earned due to the natural monopoly characteristics of petroleum pipelines and the existence of market power in some pipelines at either the upstream or downstream market. The theory holds that independent petroleum pipelines owned by companies not otherwise affiliated with the petroleum industry (independent pipelines) do not have these incentives and all the efficiencies of pipeline transportation are passed to the ultimate consumer. Integrated oil companies on the other hand, keep these cost efficiencies for themselves in the form of excess profits. DOE

N81-22516# Utah Univ., Salt Lake City. Dept. of Mechanical Engineering.
COMPARISON BETWEEN A SPRAY COLUMN AND A SIEVE TRAY COLUMN OPERATING AS LIQUID-LIQUID HEAT EXCHANGERS
Annette Keller, Harold R. Jacobs, and Robert F. Boehm Dec. 1980 130 p refs
(Contract DE-AS07-7610-01523)
(IDO-1523-5) Avail: NTIS HC A07/MF A01

The performance of the spray column as a heat exchanger was shown to correlate with the model of Letan-Kehat which has as a basis that the heat transfer is dominated by the wakeshedding characteristics of the drops over much of the column length. This model defines several hydrodynamic zones along the column of which the wake formation zone at the bottom appears to have the most efficient heat transfer. The column was also operated with four perforated plates spaced two column diameters apart in order to take advantage of the wake formation zone heat transfer. It is shown that the overall volumetric heat transfer coefficient in a perforated plate column is increased by a minimum of eleven percent over that in a spray column. A hydrodynamic model that predicts the performance of a perforated plate column is suggested. DOE

N81-22517# University of Southern California, Los Angeles. School of Architecture.
SOLAR ENVELOPE CONCEPTS: MODERATE DENSITY BUILDING APPLICATIONS Final Report
Ralph L. Knowles and Richard D. Berry Solar Energy Research Inst. Apr. 1980 144 p
(Contract DE-AC02-77CH-00178)
(SERI/SP-98155-1) Avail: NTIS HC A07/MF A01

The public policy mechanism for guaranteeing solar access is conceptualized as a solar zoning envelope that allows the largest possible building bulk on a land parcel without shadowing neighboring properties during specified times. Step-by-step methods for generating solar envelopes are described with extensive drawings, showing a variety of urban platting and lot configurations. Development and design possibilities are examined on a selected set of Los Angeles sites with typically diverse urban characteristics. Envelope attributes suitable for encouraging moderate-density commercial and residential building are examined in the context of two hypothetical but realistic development programs: one for speculative office buildings and one for condominium housing. Numerous illustrations of envelope forms and prototypical building designs are provided. DOE

N81-22518# BDM Corp., Albuquerque, N. Mex.
ANALYSIS OF THE MOUNT LAGUNA PHOTOVOLTAIC CELL FAILURE
E. Anderson, T. Lambarski, D. Kadlec, J. Nakos, and R. M. Turfler Jan. 1981 119 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7074) Avail: NTIS HC A06/MF A01

The primary factors which can cause individual P/V cells in a module or an array to be forced into reverse bias and eventual failure are described and guidelines for adequate protection of the array are provided. The primary mode of cell failure identified is outgassing which eventually produces cracked cells. Each of the factors was evaluated in a module of 40 individual cells and in a string of 14 modules for the full range of the module and string operating voltages. A relationship between reverse bias and P/V cell temperature was developed. DOE

N81-22519# Booz-Allen and Hamilton, Inc., Bethesda, Md.
GEOTHERMAL INDUSTRY ASSESSMENT
Jul. 1980 321 p
(Contract DE-AC03-79PE-70090)
(DOE/PE-70090/T2) Avail: NTIS HC A14/MF A01

Focus is on industry structure, corporate activities and strategies, and detailed analysis of the technological, economic, financial, and institutional issues important to government policy formulation. The study is based principally on confidential interviews and with executives of 75 companies active in the field. DOE

N81-22520# Midwest Research Inst., Golden, Colo.
CURRENT AND FUTURE INDUSTRIAL ENERGY SERVICE CHARACTERIZATIONS. VOLUME 2: ENERGY DATA ON THE US MANUFACTURING SUBSECTOR Final Report
F. Krawiec, Tom Thomas, Frederick Jackson, Dilip R. Limaye, Steve Isser, Ken Karnofsky, and Todd D. Davis Oct. 1980 271 p Prepared in cooperation with Synergic Resources Corp., Bala Cynwyd, Pa.
(Contract DE-AC02-77CH-00178)
(SERI/TR-733-790-VOL-2) Avail: NTIS HC A12/MF A01

In order to characterize industrial energy service, current energy demand, its end uses, and cost of typical energy applications and resultant services in the industrial sector were examined and a projection of state industrial energy demands and prices to 1990 was developed. Volume 2 presents in Section 2 data on the US manufacturing subsector energy demand, intensity, growth rates, and cost for 1971, 1974, and 1976. These data characterize typical energy applications and the resultant service in this subsector. Section 3 presents the computer program used to produce the tabulated data. DOE

N81-22521# Midwest Research Inst., Golden, Colo.
CURRENT AND FUTURE INDUSTRIAL ENERGY SERVICE CHARACTERIZATIONS. VOLUME 3: ENERGY DATA ON 15 SELECTED STATES MANUFACTURING SUBSECTOR Final Report
F. Krawiec, Tom Thomas, Frederick Jackson, Dilip R. Limaye, Steve Isser, Ken Karnofsky, and Todd D. Davis Oct. 1980 962 p Prepared in cooperation with Synergic Resources Corp., Bala-Cynwyd, Pa.
(Contract DE-AC02-77CH-00178)
(SERI/TR-733-790-Vol-3) Avail: NTIS HC A99/MF A01

An examination is made of the current and future energy demands, end uses, and cost to characterize typical applications and resulting services in the US and industrial sectors of 15 selected states. Tables containing data on selected states manufacturing subsector energy consumption, functional uses, and cost in 1974 and 1976 are included. Alabama, California, Illinois, Indiana, Louisiana, Michigan, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Texas, West Virginia, and Wisconsin were chosen as having the greatest potential for replacing conventional fuel with solar energy. Basic data on the quantities, cost, and types of fuel and electric energy purchased by industry for heat and power were obtained from the 1974 and 1976 Annual Survey of Manufacturers. DOE

N81-22522# Science Applications, Inc., McLean, Va.
HOT GAS CLEANUP FOR MOLTEN CARBONATE FUEL CELLS: A ZINC REACTOR MODEL Final Report
George Steinfeld 16 Sep. 1980 91 p refs
(Contracts DE-AT21-78MC-08333; DE-AM21-78MC-08333)
(DOE/METC-08333/105) Avail: NTIS HC A05/MF A01

Of the two near term options available for desulfurization of gasifier effluent, namely low temperature cleanup utilizing absorber/stripper technology, and hot gas cleanup utilizing metal oxides, there is a clear advantage to using hot gas cleanup. Since the MCFC will operate at 1200 F, and the gasifier effluent could be between 1200 to 1900 F, a hot gas cleanup system will require little or no change in process gas temperature, thereby contributing to a high overall system efficiency. Simulated operating characteristics to aid in system design and system simulations of gasifier/MCFC systems are described. The modeling of the ZnO reactor is presented. DOE

N81-22523# Hittman Associates, Inc., Columbia, Md.
BATTERY RESOURCE ASSESSMENT. BATTERY DEMANDS SCENARIOS MATERIALS Interim Report
Daniel Sullivan Dec. 1980 54 p refs
(Contract DE-AC02-80CH-10026)
(DOE/CH-10026/T4; HC2002/021-80-9921; IR-1) Avail: NTIS HC A04/MF A01

Projections of demand for batteries and battery materials between 1980 and 2000 are presented. The estimates are based on existing predictions for the future of the electric vehicle, photovoltaic, utility load-leveling, and existing battery industry. Battery demand was first computed as kilowatt-hours of storage for various types of batteries. Using estimates for the materials required for each battery, the maximum demand that could be expected for each battery material was determined. DOE

N81-22524# Hittman Associates, Inc., Columbia, Md.
BATTERY RESOURCE ASSESSMENT. SUBTASK 2.5: BATTERY MANUFACTURING CAPABILITY RECYCLING OF BATTERY MATERIALS Final Report
Paul Pemsler Feb. 1981 40 p
(Contract DE-AC02-80CH-10026)
(DOE/CH-10026/T5; H-C2002/021-81-992-4) Avail: NTIS HC A03/MF A01

Studies were conducted on the recycling of advanced battery system components for six different battery systems. These include: nickel/zinc, nickel/iron, zinc/chlorine, zinc/bromine, sodium/sulfur, and lithium-aluminum/iron sulfide. For each battery system, one or more processes were developed which would permit recycling of the major or active materials. Each recycle process was designed to produce a product material which can be used directly as a raw material by the battery manufacturer. Metal recoverabilities are in the range of 93 to 95% for all processes. In each case, capital and operating costs were developed for a recycling plant which processes 100,000 electric vehicle batteries per year. DOE

N81-22525# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
POTENTIAL INDUSTRIAL APPLICATIONS FOR DIRECT CONTACT WASTE HEAT RECUPERATOR SYSTEMS Final Report
T. T. Semler Feb. 1981 216 p refs
(Contract DE-AC07-76ID-01570)
(EEG-CS-5328) Avail: NTIS HC A10/MF A01

Four potential applications were chosen for economic analysis. They are: stack gas from diesel electric generation, boiler stack gas, waste heat stream from the hydraulic cement dry process dryer, and stack gas from the fire polishing of glass. The waste heat streams studied ranged from 175 to 7500 F. A physical analogue of the direct contact waste heat recuperator system was devised and used for costing purposes. Payback calculations were performed for these applications. Only the stack gas from the fire polishing of glass failed to show significant economic promise. A waste heat stream regime of greater than 10,000 cfm and between 400 and 7500 F was identified as most economically promising for direct contact waste heat recuperation and hot process water delivery. DOE

N81-22526# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
DESIGN REPORT SMALL-SCALE FUEL ALCOHOL PLANT. VOLUME 2: DETAILED CONSTRUCTION INFORMATION
Dec. 1980 313 p
(Contract DE-AC07-76ID-01570)
(IDO-10088-Vol-2) Avail: NTIS HC A14/MF A01

The objectives are to provide potential alcohol producers with a reference design and provide a complete, demonstrated

design of a small scale fuel alcohol plant. The plant has the capability for feedstock preparation, cooking, saccharification, fermentation, distillation, by-product dewatering, and process steam generation. An interesting feature is an instrumentation and control system designed to allow the plant to run 24 hours per day with only four hours of operator attention. DOE

N81-22527# ARO, Inc., Arnold Air Force Station, Tenn.
REPORT ON THE MHD PERFORMANCE DEMONSTRATION EXPERIMENT Progress Report, 1 Oct. 1979 - 30 Sep. 1980
R. F. Starr, L. S. Christensen, G. L. Whitehead, G. W. Garrison, B. L. Seiber, and R. L. Lowry AEDC Oct. 1980 156 p refs
(Contract DE-AI01-78ET-11417; ET-78-I-01-2895)
(FE-2895-10) Avail: NTIS HC A08/MF A01

Initial experimental results were obtained with the channel configured in the Faraday mode. The resistive loading was selected to give low supersonic velocities over the entire channel length. Tests were conducted at magnetic fields up to 4.1 Telsa (T) (70 percent of design). Up to 23.5 MW of power were produced to date (50 percent of design) for an enthalpy extraction of approximately 9 percent. Several electrical and hardware deterioration problems developed during operation. High voltage electrical failures, such as arcs to ground at several locations at the high voltage end of the system and in the load circuit occurred. Nozzle erosion and significant electrode cap ablation near the channel inlet were also observed. DOE

N81-22528# Dynatech R/D Co., Cambridge, Mass.
PEAT BIOGASIFICATION DEVELOPMENT PROGRAM Quarterly Progress Report, 1 Oct. - 31 Dec. 1980
Donald L. Wise 15 Jan. 1981 23 p
(Contract DE-AC01-79ET-14696; DYNATECH Proj. MGC-2)
(DOE/ET-14696/T5; QPR-5; Rept-2100) Avail: NTIS HC A02/MF A01

The design and operation of a peat anaerobic digestion process development unit is considered. Five areas are addressed: pretreatment information; anaerobic digestion; evaluation of waste streams; process model development and economic analysis; and planning for the process development unit. Data were taken for the development of the predictive process model. A number of batch and continuous pretreatment experiments were completed and analyzed. The four samples analyzed through solvent extration were completed, and the results are presented. Work on high pressure liquid chromatography continued, and the development of the gradient elution solvent system was completed with encouraging results. Pretreated peat was batch fermented; the continuously oxidized peat show conversions of close to 30 percent. This is significantly higher than the conversion for the batch oxidized peat. A predictive process model for the three phases of peat biogasification, solubilization, oxidation, and fermentation was developed. DOE

N81-22529# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS BORON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY GLOW DISCHARGE DECOMPOSITION METHODS Final Report, 1 Jan. 1979 - 31 May 1980
Franklin H. Cocks, Phillip L. Jones, Louis J. Dimmey, Stuart F. Cogan, and Hymog Park May 1980 21 p refs
(Contract DE-AC03-79ET-23041)
(DOE/ET-23041/4) Avail: NTIS HC A02/MF A01

The presence of hydrogen in the films in the range of 5 to 34% has been confirmed by residual gas analysis. The optical band gaps of these films can be varied from as much as 2.2 eV to 0.9 eV by vacuum annealing. In particular, films with optical gaps close to the optimum (1.45 eV) for solar cell applications can be readily produced either by post deposition annealing or the use of substrates heated to 3500 C. Heating of the substrates during deposition of the films produced varying optical gaps. Evolution of incorporated hydrogen by these means is believed to lead to the lowering of the optical gap. Boron films produced from plasmas into which small amounts of silane and hydrogen were introduced showed lower activation energies for conduction than did the intrinsic a-B:H films. DOE

N81-22530# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS SILICON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY ION PLATING TECHNIQUES Final Report, 1 Jan. 1979 - 31 May 1980
Franklin H. Cocks, Phillip L. Jones, Stuart F. Cogan, Louis J. Dimmey, Barry L. Zalph, Alan S. Scharman, Anti Korhonen, and Steven Wright May 1980 45 p refs
(Contract DE-AC03-79ET-23035)
(DOE/ET-23035/4) Avail: NTIS HC A03/MF A01

The technique involves essentially the evaporation of elemental silicon through a d.c. produced hydrogen plasma. In this way hydrogen successfully incorporated into amorphous silicon films in concentrations as high as 30 atomic percent. Infrared spectroscopy indicates the usual SiH sub x stretching mode at approximately 2000/cm. Further evidence for the bonding of hydrogen was obtained from ESR measurement of hydrogenated and unhydrogenated samples. The measured unpaired spin density was a factor of 25 less in the hydrogenated sample. The optical absorption edges of the hydrogenated films fell in the usual range between 1.7 and 1.9 eV. Electrical conductivity measurements indicated a substantial reduction in the density of defect states in the gap as expected. DOE

N81-22531# InterTechnology Solar Corp., Warrenton, Va. Solar Marketing and Manufacturing Div.
REVIEW OF THE CURRENT STATUS OF REVERSE ELECTRODIALYSIS SYSTEMS FOR SALINITY POWER SYSTEMS USING A STRATIFIED SATURATED SOLAR POND Final Report
22 Feb. 1980 47 p refs
(Contract DE-AC05-78ET-20471)
(DOE/ET-20471/T1; Rept-220280) Avail: NTIS HC A03/MF A01

It is shown that the electrical resistance of the present day membranes, which are produced for electrodialysis and not reverse electrodialysis, and the solution compartments are very high. This causes the power density of present day RED stacks, in terms of watts per unit membrane area, to be very low. This factor combined with the high cost of present day membranes results in very high costs for the RED stack. Furthermore, present day membranes as well as adhesives for membrane assemblies cannot operate at about 800 C for any reasonable length of time without severe deterioration in performance. DOE

N81-22532# Carnegie-Mellon Univ., Pittsburgh, Pa.
ALTERNATIVE FUTURE SCENARIOS FOR THE SPS COMPARATIVE ASSESSMENT
R. U. Ayres, R. G. Ridker (Resources for the Future, Inc.), W. D. Watson, Jr. (Geological Survey, Denver, Colo.), J. Arnold (Variflex Corp.), and G. Tayi Aug. 1980 152 p refs
(Contracts W-21-109-eng-38; W-31-109-eng-38)
(ANL/EES-TM-120) Avail: NTIS HC A08/MF A01

Terrestrial alternatives are selected, and their cost, performance, and environmental and social attributes are specified for use in the comparison with the SPS in the post 2000 era. Data on alternative technologies were sought from previous research and from other comparisons. The economic/energy interactions are discussed, and a number of specific modelling schemes that were used for long range forecasting purposes are described. This discussion provides the rationale for the choice of a specific model and methodology, which is described. Long range cost assumptions used in the forecast are detailed, and the basis for the selection of specific scenarios follows. Results of the analysis are detailed. DOE

N81-22533# Research Triangle Inst., Research Triangle Park, N. C.
DEVELOPMENT OF HIGH EFFICIENCY, LOW COST ZnSs2 SOLAR CELLS Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1980
J. E. Andrews 1980 15 p
(Contract DE-AC04-79ET-23001)
(COO-3001-4; QTPR-4) Avail: NTIS HC A02/MF A01

The p-ZnSiAs2/n-GaAs structures fabricated earlier were analyzed using the Electron Beam Induced Current technique and were found to have a diffused p-n junction in the GaAs.

The short circuit current density associated with this structure was found to be a factor of 2 to 3 lower than predicted when analyzed as a ZnSiAsw/GaAs heteroface structure (the ZnSiAs2 was assumed to behave as a window layer). Epitaxial growth was demonstrated for two additional substrates. DOE

N81-22534# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
ADVANCED AMORPHOUS MATERIALS FOR PHOTOVOLTAIC CONVERSION Semiannual Report, 1 Oct. 1979 - 31 Mar. 1980
R. W. Griffith, A. E. Delanoy, M. D. Hirsh, F. J. Kampas, and P. E. Vanier 1980 38 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51260) Avail: NTIS HC A03/MF A01

The following activities were emphasized in the program: an expansion of plasma studies using optical emission spectroscopy in order to identify emitting reactive species due to impurities; and electrical and optical measurements on alloys with calibrated impurity levels by measurements of photoconductivity, photoluminescence, vibrational spectroscopy, etc. The apparatus for device measurements of spectral response, dark I-V characteristics, illuminated I-V characteristics, etc., was completed. DOE

N81-22535# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.
SYSTEM MANUAL FOR THE UNIVERSITY OF PENNSYLVANIA RETROFITTED SOLAR HEATED PHILADELPHIA ROW HOME (SOLAROW)
Irwin Zinnes and Noam Lior May 1980 212 p refs
(Contracts DE-AS02-77CS-34142; EG-77-S-02-4142)
(COO-4142-4) Avail: NTIS HC A10/MF A01

The heating and instrumentation systems are described, the details for instrumentation are provided, piping and valve identification are given and the operation and maintenance of the heating and data acquisition systems are specified. The following are included: system flow diagrams; valve and cable identification tables; wiring diagrams; and start up, normal operation, shut down, maintenance and trouble shooting procedures. It thus provides the necessary technical information to permit system operation and monitoring, overall system performance analysis and optimization, and acquisition of climatological data. DOE

N81-22536# Department of Energy, Washington, D. C. Assistant Secretary of Conservation and Solar Energy.
DISTRIBUTED THERMAL ENERGY STORAGE IN THE RESIDENTIAL SECTOR: COMMERCIALIZATION-READINESS ASSESSMENT AND IMPLEMENTATION STRATEGY
Aug. 1980 92 p
(DOE/CS-0195) Avail: NTIS HC A05/MF A01

It was concluded that TES systems for residential space and hot-water heating are technically and economically ready for commercialization. TES systems are unlikely to be more attractive than standard-heat-pump systems in all areas of the country; however, in many regions, particularly in the northeast and north central states, TES appears to be more attractive. Environmental, market and economic, and institutional-readiness studies are presented. Market penetration and benefit analysis are summarized. Barriers to commercialization are identified along with strategies for overcoming the barriers. Schedules and resource requirements are discussed. DOE

N81-22537# Argonne National Lab., Ill.
DESIGN REQUIREMENTS FOR ORBIT MAINTENANCE OF SPS ELEMENTS
Nov. 1980 70 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0087) Avail: NTIS HC A04/MF A01

The LEO Staging Base, Electric Orbit Transfer Vehicle, the LEO Construction Base, and SPS Self-Power Module are the SPS elements selected for this analysis. The orbit decay rates and attitude control/orbit maintenance propellant requirements for nominal and worst case conditions are defined. The sequence of events that could cause unplanned reentry are defined. The design and operational requirements that will be used to prevent the various elements from deorbiting are defined. DOE

N81-22538# Chicago Univ., Ill.
NONIMAGING CONCENTRATORS FOR SOLAR THERMAL ENERGY Final Report
R. Winston and Joseph J. Gallagher 21 Mar. 1980 99 p refs
(Contracts DE-AS02-76ET-20236; EY-76-S-02-2446)
(DOE/ET-20236/18) Avail: NTIS HC A05/MF A01

A small experimental solar collector test facility was used to explore applications of nonimaging optics for solar thermal concentration in three substantially different configurations: a single stage system with moderate concentration on an evacuated absorber (a 5.25X evacuated tube Compound Parabolic Concentrator or CPC), a two stage system with high concentration and a non-evacuated absorber (a 16X Fresnel lens/CPC type mirror) and moderate concentration single stage systems with non-evacuated absorbers for lower temperature (a 3X and a 6.5X CPC). Prototypes of each of these systems were designed, built and tested. The performance characteristics are presented. DOE

N81-22539# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Progress Report
L. E. McNeese Feb. 1981 124 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7682) Avail: NTIS HC A06/MF A01

The projects reported include those for coal conversion development, chemical research and development, materials technology, component development and process evaluation studies, technical support to major liquefaction projects, process analysis and engineering evaluations, fossil energy environmental analysis, flue gas desulfurization, plant control development, atmospheric fluidized bed coal combustor for cogeneration, TVA, FBC demonstration plant program technical support, and PFBC systems analysis. Fossil fuel application assessments, performance assurance system support for fossil energy projects, international energy technology assessment, and general equilibrium models of liquid and gaseous fuel supplies are presented. DOE

N81-22540# Oak Ridge National Lab., Tenn. Chemistry Div.
PHYSICAL CHEMISTRY OF MOLTEN SALT BATTERIES CURRENT INDUCED COMPOSITION GRADIENTS IN MOLTEN LiCl-KCl Final Report, 1 Oct. 1979 - 30 Sep. 1980
J. Braunstein, S. Cantor, and C. E. Vallet Mar. 1981 19 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7639) Avail: NTIS HC A02/MF A01

The gradients were produced by electrolysis of the salt between LiAl electrodes at currents of 50 to 100 mA/sq cm, and quenching. Analysis of composition profiles in quenched samples was by atomic absorption spectroscopy, which gave good precision, and by X-ray fluoresence spectroscopy in a scanning electron microscope (SEM/EDX), which gave good distance resolution. DOE

N81-22541# Oak Ridge National Lab., Tenn. Energy Div.
PERFORMANCE AND ECONOMICS OF THE ACES AND ALTERNATIVE RESIDENTIAL HEATING AND AIR CONDITIONING SYSTEMS IN 115 US CITIES
L. A. Abbatiello, E. A. Nephew, and M. L. Ballou Mar. 1981 237 p refs
(Contract W-7405-eng-26)
(ORNL/CON-52) Avail: NTIS HC A11/MF A01

The efficiency and life cycle costs of the brine chiller minimal annual cycle energy system (ACES) for residential space heating, air conditioning, and water heating requirements are compared with three conventional systems. The conventional systems evaluated are a high performance air-to-air heat pump with an electric resistance water heater, an electric furnace with a central air conditioner and an electric resistance water heater, and a high performance air-to-air heat pump with a superheater unit for hot water production. Monthly energy requirements for a reference single family house are calculated, and the initial cost and annual energy consumption of the systems, providing identical energy services, are computed and compared. The ACES consumes one third to one half ot the electrical energy required

by the conventional systems and delivers the same annual loads at comparable costs. J.D.H.

N81-22542# General Electric Co., Schenectady, N. Y. Fuel Cell Program Office.
MOLTEN CARBONATE FUEL CELL LARGE STACK DEVELOPMENT
L. J. Degan Jun. 1980 187 p refs
(NYSERDA-80-17) Avail: NTIS HC A09/MF A01

The development of molten carbonate fuel cell (MCFC) power plants is described. Possible electrode materials were evaluated for chemical stability and conductivity. Dual porosity electrodes and the electroless plating of nickel on SrTiO3 for electrode material were investigated. The requirements and recommendations of four major utilities and three industrial plants are summarized. Two coal gasifiers for use in a large coal fired MCFC plant were evaluated. The stack configurations are defined and the preliminary design of a fuel cell stack using internal manifolds and counterflow of the fuel and oxidant is presented. Specifications, drawings, and materials recommendations are included. J.D.H.

N81-22543# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
GEOTHERMAL RESOURCE AREAS DATABASE FOR MONITORING THE PROCRESS OF DEVELOPMENT IN THE UNITED STATES
J. Dennis Lawrence, Susan R. Lepman, Keith N. Leung, and Sidney L. Phillips Jan. 1981 73 p refs
(Contract W-7405-eng-48)
(LBL-10418) Avail: NTIS HC A04/MF A01

The Geothermal Resource Areas Database (GRAD) and associated data system provide broad coverage of information on the development of geothermal resources in the United States. The system is designed to serve the information requirements of the National Progress Monitoring System. GRAD covers development from the initial exploratory phase through plant construction and operation. Emphasis is on actual facts or events rather than projections and scenarios. The selection and organization of data are based on a model of geothermal development. Subjects in GRAD include: names and addresses, leases, area descriptions, geothermal wells, power plants, direct use facilities, and environmental and regulatory aspects of development. Data collected in the various subject areas are critically evaluated, and then entered into an on-line interactive computer system. The system is publically available for retrieval and use. The background of the project, conceptual development, software development, and data collection are described as well as the structure of the database. DOE

N81-22544# Los Alamos Scientific Lab., N. Mex.
SOLAR ENERGY RESEARCH AT LASL Progress Report, 1 Oct. 1979 - 31 Mar. 1980
Sherry K. Reisfeld, comp. and Donald A. Neeper, comp. Nov. 1980 56 p refs
(Contract W-7405-eng-36)
(LA-8450-PR) Avail: NTIS HC A04/MF A01

The Solar Energy Group, Q-11, conducted passive solar heating research and collector testing. In addition, the group provided technical support to the Department of Energy, Office of Solar Applications for Buildings, for both solar collector and passive system development. DOE

N81-22545# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
THIN FILMS OF InP FOR PHOTOVOLTAIC ENERGY CONVERSION Quarterly Technical Progress Report, 29 Dec. 1979 - 28 Mar. 1980
Harold M. Manasevit, Ralph P. Ruth, Lavada A. Moudy, Jane J. J. Yang, and Richard E. Johnson Apr. 1980 39 p refs
(Contract DE-AC02-79ET-23004)
(COO-3004-3; QTPR-3) Avail: NTIS HC A03/MF A01

The development of a low cost high efficiency thin film InP heterojunction solar cell based on InP films grown by the metalorganic chemical vapor deposition (MO CVD) is discussed. Experiments continued on evaluation of GaP as an intermediate layer material for subsequent growth of InP films on various substrate materials, and Cd (obtained from dimethylcadmium) was evaluated as a p-type dopant (an alternative to Zn obtained from diethylzinc) for InP films made by the MO-CVD process. A preliminary X-ray diffraction analysis was conducted of the crystallographic structure of the vacuum-deposited CdS films prepared as part of the process of fabricating CdS/InP heterojunction solar cells. A group of CdS/InP heterostructure cells involving vacuum-deposited CdS and p-type epitaxial InP films grown by MO-CVD was prepared and evaluated. High J0 values and low fill factors were observed in all of the cells, resulting in AM1.5 efficiencies in the 2 to 5 percent range. DOE

N81-22546# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
ALPHA-PLY LAMINATED-DISC FLYWHEEL ROTOR
R. P. Nimmer 1980 9 p refs
(Contract W-7405-eng-48)
(UCRL-15307) Avail: NTIS HC A02/MF A01

The composite flywheel is made up of a laminated S2-glass/epoxy disc and a filament wound graphite/epoxy outer ring. The two components are assembled with an interference fit and an aluminum hub is elastomerically bonded to the central disc. With this approach both high energy density and high volume efficiency should be attainable. Two hybrid disc/ring flywheels were built and tested. As a part of the design process, extensive information was gathered with respect to failure modes, material properties, residual stresses and dynamic characteristics. The improved design of these larger wheels should be reflected by energy densities in the vicinity of 60 to 66 Wh/kg (27 to 30 Wh/lb.). DOE

N81-22547# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION SCATTERGOOD SCHOOL, WEST BRANCH, IOWA, JUNE 1979 - APRIL 1980
Eric M. Schatzberg 1980 84 p refs
(SOLAR/2003-80/14) Avail: NTIS HC A05/MF A01

The Scattergood School solar energy system supplied 93% of the space heating and 50% of the domestic hot water required for the school. The system operated from June 1979 to April 1980 with no mechanical failures. The grain drying subsystem was used during the last two weeks of October. Operation of the grain drying subsystem considerably improved overall system performance. DOE

N81-22548# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ECONOMIC ANALYSIS OF COMMUNITY SOLAR HEATING SYSTEMS THAT USE ANNUAL CYCLE THERMAL ENERGY STORAGE
F. Baylin, R. Monte, S. Sillman, F. C. Hooper, and J. D. McClenahan Feb. 1981 44 p refs Prepared in cooperation with Toronto Univ., Ontario
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TR-721-898) Avail: NTIS HC A03/MF A01

Systems were sized for three housing configurations: single unit dwellings, 10 unit, and 200 unit apartment complexes in 50, 200, 400, and 1000 unit communities in 10 geographic locations in the United States. Thermal energy is stored in large, constructed, underground tanks. Costs were assigned to each component of every system in order to allow calculation of total costs. Results are presented as normalized system costs per unit of heat delivered per building unit. These methods allow: identification of the relative importance of each system component in the overall cost; and identification of the key variables that determine the optimum sizing of a district solar heating system. DOE

N81-22549# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
GROWTH OF SILICON SHEETS FOR PHOTOVOLTAIC APPLICATIONS
Thomas Surek Dec. 1980 18 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TR-614-921) Avail: NTIS HC A02/MF A01

Silicon sheet growth processes are classified according to their linear growth rates. The fast growth processes, which include edge-defined film-fed growth, silicon on ceramic,

dendritic-web growth, and ribbon-to-ribbon growth, were comparatively ranked subject to criteria involving growth stability, sheet productivity, impurity effects, crystallinity, and solar cell results. The status of more rapid silicon ribbon growth techniques, such as horizontal ribbon growth and melt quenching, was also reviewed. The emphasis of the discussions is on examining the viability of these sheet materials as solar cell substrates for low-cost silicon photovoltaic systems. DOE

N81-22550# Midwest Research Inst., Golden, Colo. International Div.

SOLAR ENERGY IN ARGENTINA: A PROFILE OF RENEWABLE ENERGY ACTIVITY IN ITS NATIONAL CONTEXT

Donna Hawkins Jan. 1981 50 p refs

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/SP-763-719; SERI/SP-763-1002) Avail: NTIS HC A03/MF A01

The following subjects are covered: The country overview; the energy summary; the geopolitical, economic, and cultural aspects of the Republic of Argentina; the energy profile; and international contacts, manufacturers, and projects. DOE

N81-22551# Mobil Tyco Solar Energy Corp., Waltham, Mass.

AMORPHOUS-SILICON THIN-FILM HETEROJUNCTION SOLAR CELLS Progress Report, 1 Mar. - 1 Dec. 1980

Mary C. Cretella, James Gregory, Donald B. Sandstrom, and William Paul (Harvard Univ.) Jan. 1981 29 p

(Contracts DE-AC02-77CH-00178; EG-77-C-C1-4042)

(SERI/PR-9056-1-T1) Avail: NTIS HC A03/MF A01

Amorphous silicon materials were investigated (1) to improve the amorphous material, and (2) to attempt to understand and improve on the limitations of the junction devices while evaluating the amorphous silicon materials. The modifications to the a-Si(H) network by alloying silicon with other group IVA elements, either in binary or ternary compositions, and/or by replacing the hydrogenation for defect compensation with a combination of hydrogenation and alkylation or hydrogenation and halogenation are examined. The doped junction layers are examined in an attempt to determine the limiting characteristics of the junctions in solar cell devices of these amorphous materials. The optical properties were measured, and structural and compositional information was obtained from the IR vibrational spectra using the scanning electron microscope and from analyses using scanning Auger microscopy. Electrical measurements include the dark conductivity and the photoconductivity under room fluorescent light and at AM1 conditions. With alloys that displayed promising photoconductive properties n-i-p devices are prepared to assess the solar cell properties. DOE

N81-22552# Sandia Labs., Livermore, Calif.

SIMPLE THEORY FOR PREDICTING THE NATURAL CONVECTIVE ENERGY LOSS FROM SIDE-FACING SOLAR CAVITY RECEIVERS

M. Abrams and R. Greif Jan. 1981 45 p refs

(Contract DE-AC04-76DP-00789)

(SAND-81-8201) Avail: NTIS HC A03/MF A01

The approach used is to determine the velocity distribution of the incoming air in the aperture plane (and thereby the rate of mass entrainment); and then to estimate the bulk temperature of the heated emerging air. The convective loss is then calculated from a energy balance. To illustrate this theory, numerical results applicable to the 2.15 meter cubic cavity being tested in the laboratory are provided. DOE

N81-22553# Northrup, Inc., Hutchins, Tex.

SECOND GENERATION HELIOSTAT DEVELOPMENT DETAILED DESIGN REPORT. VOLUME 1: TECHNICAL DISCUSSION Technical Report, 16 Jul. 1979 - 30 Apr. 1980

1980 265 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-8194-Vol-1) Avail: NTIS HC A12/MF A01

Presented are the design of the second generation heliostat, the development of the manufacturing plan, the method of transporting the heliostats from the factory to the installation site, heliostat installation procedures, and the maintenance routines. These plans were then cost estimated to provide inputs required to develop the installed cost of the heliostat and further, the cost of owning, operating and maintaining a collector field. DOE

N81-22554# Argonne National Lab., Ill.

PRELIMINARY OPTICAL DESIGN OF A SECOND-STAGE CONCENTRATOR FOR THE CRTF Final Report

K. A. Reed Feb. 1981 66 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-7108) Avail: NTIS HC A04/MF A01

The definition and design of a water cooled, second stage compound parabolic concentrator to be employed in the MDAC/R receiver panel testing are described. A simplified flux model (SFM) was developed to permit fast computation of the total power normally incident on an arbitrary planar target aperture from some or all of the heliostats in the field. For each second stage concentrator configuration studied, the total power normally incident on each entrance aperture was calculated using the SFM, and then the net power delivered to the MDAC/R receiver panel was calculated from the optical transmission of the concentrator. The SFM code is included. DOE

N81-22555# AiResearch Mfg. Co., Phoenix, Ariz.

RESIDENTIAL ENERGY STORAGE FLYWHEEL WITH A WIND TURBINE SUPPLY

T. W. Place Apr. 1981 103 p

(Contract DE-AC04-76DP-00789)

(SAND-79-7098; AiResearch-79-76189) Avail: NTIS HC A06/MF A01

The conceptual design was developed for a minimum cost flywheel energy storage system which is suitable for mechanical interfacing with a wind-turbine energy source. The system has 10 kWh storage capacity and provides 5 kW peak power/output. Emphasis was placed on assuring that the system design is adaptable for upward-scaling to 50 kWh storage capacity and 10 kW peak power output. The system will provide 76 percent round trip efficiency and 1 percent/h maximum rundown loss. For production rates of 100,000 units per year, the estimated selling prices for the system in the 10 kWh and 50 kWh storage sizes are $3581 ($358/kWh) and $9800 ($196/kWh), respectively. DOE

N81-22556# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Systems Technology Div.

ECONOMIC ASSESSMENT PHOTOVOLTAIC/BATTERY SYSTEMS Final Report

J. T. Day, T. P. Hayes, and W. J. Hobbs Feb. 1981 132 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-7083) Avail: NTIS HC A07/MF A01

The economics of residential PV/battery systems were determined from the utility perspective using detailed computer simulation to determine marginal costs. Brief consideration is also given to the economics of customer ownership, utility distribution system impact, and the implications of PURPA. DOE

N81-22557# Sandia Labs., Albuquerque, N. Mex.

SOLAR RADIATION MODEL VALIDATION

Irving J. Hall, Richard R. Prairie, Herbert E. Anderson, and Eldon C. Boes Oct. 1980 126 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-1755) Avail: NTIS HC A05/MF A01

Several mathematical models were developed which estimate the solar radiation from other weather variables. Some of these models were used to generate data bases which are extensively used in the design and analysis of solar systems. Three of these solar radiation models were used in developing the Augmented SOLMET Solar Data Tapes for the 26 SOLMET sites and the 222 ERSATZ Solar Data Tapes. One of the models, a theoretical one, predicts the solar noon radiation for clear sky conditions from the optical air mass, precipitable water vapor and turbidity variables. A second model, an empirical one, predicts the hourly total horizontal radiation from meteorological variables. And, a third model, also an empirical one, predicts the hourly direct normal radiation from the hourly total horizontal radiation. DOE

N81-22558# Battelle Pacific Northwest Labs., Richland, Wash.

INVESTIGATIONS ON CATALYZED STEAM GASIFICATION OF BIOMASS. APPENDIX A: FEASIBILITY STUDY OF

METHANE PRODUCTION VIA CATALYTIC GASIFICATION OF 2000 TONS OF WOOD PER DAY

L. K. Mudge, S. L. Weber, D. H. Michell, L. J. Sealock, Jr., and R. J. Robertus Jan. 1981 135 p Prepared in cooperation with McKee (Davy) Corp., Cleveland

(Contract DE-AC06-76RL-01830)

(PNL-3695-App-A) Avail: NTIS HC A07/MF A01

The plant is designed to process 2000 tons per day of dry wood to SNG. Plant production is 21.6 MM scfd of SNG with a HHV of 956 Btu per scf. All process and support facilities necessary to convert wood to SNG are included. The plant location is Newport, Oregon. The capital cost for the plant is $95,115,000 September, 1980 basis. Gas production costs which allow for return on capital were calculated for various wood prices for both utility and private investor financing. DOE

N81-22559# Battelle Pacific Northwest Labs., Richland, Wash. Pacific Northwest Lab.

SUMMARY OF THREE REGIONAL ASSESSMENT STUDIES OF SOLAR ELECTRIC GENERATION OPPORTUNITIES IN THE SOUTHWEST, SOUTHEAST, AND NORTHEAST UNITED STATES

R. L. Watts and H. Harty Feb. 1981 38 p refs

(Contract DE-AC06-76RL-01830)

(PNL-3030) Avail: NTIS HC A03/MF A01

The evaluations were based on both economic analyses and user perception of what they would require to select or approve the use of solar electric generation for themselves or for their employers. Over 30 utilities and several industrial and commerical firms and homeowners were involved. Solar electric technologies considered included biomass, hybrid retrofit, OTEC, photovoltaic, solar thermal, and wind. The studies projected that solar electric technologies could account for several percent of the forecast generation in year 2000 in the Southeast and Southwest regions, and up to 10 to 20% in the Northeast region. DOE

N81-22560# Hanford Engineering Development Lab., Richland, Wash.

HEDL/SERI PHOTOVOLTAIC PROGRAM Annual Report

R. W. Davis, D. R. Green, L. C. Olsen, L. S. Price, and C. N. Wilson Oct. 1980 54 p refs

(Contract DE-AC14-76FF-02170)

(HEDL-TC-1835) Avail: NTIS HC A04/MF A01

Progress is reported on development of a solar cell material analysis service and producing detailed reports on current solar cell measuring methods including resistivity, Hall effect, Seeback effect, dark and illuminated current-voltage characteristics, capacitance-voltage measurement, and spectral response measurements. Research on advanced measurement technology is reported including ellipsometry and electro-thermal and spatial spectral response scanning for polycrystalline solar cells. DOE

N81-22561# PRC Toups, Orange, Calif.

GEOTHERMAL SPACE HEATING APPLICATIONS FOR THE FORT BECK INDIAN RESERVATION IN THE VICINITY OF POPLAR, MONTANA Final Report, 20 Aug. 1979 - 31 May 1980

J. H. Birman, Jane Cohen, and Glenn J. Spencer Oct. 1980 177 p refs

(Contract DE-FC07-79ID-12046)

(DOE/ID-12046/4) Avail: NTIS HC A09/MF A01

A preliminary assessment of the resource characteristics, a preliminary design and economic evaluation of a geothermal heating district and an analysis of environmental and institutional issues are included. Preliminary investigations were also made into possible additional uses of the geothermal resource, including ethanol production. The preliminary heating district system effort for the town of Poplar included design heat load estimates, a field development concept, and preliminary design of heat extraction and hot water distribution systems. DOE

N81-22562# Oregon State Univ., Corvallis. Dept. of Mechanical Engineering.

HEAT PUMPS FOR GEOTHERMAL APPLICATIONS: AVAILABILITY AND PERFORMANCE Final Report

Gordon M. Reistad and Paul Means May 1980 80 p refs

(Contract DE-FC07-79ID-12020)

(DOE/ID-12020/T1) Avail: NTIS HC A05/MF A01

A study of the performance and availability of water source heat pumps was carried out. The primary purposes were to obtain the necessary basic information required for proper evaluation of the role of water source heat pumps in geothermal energy utilization and/or to identify the research needed to provide this information. The commercial water source heat pump industry is considered in regard to both the present and projected availability and performance of units. Performance evaluations are made for units that use standard components but are redesigned for use in geothermal heating. DOE

N81-22563# San Diego Gas and Electric Co., Calif.

GEOTHERMAL LOOP EXPERIMENTAL FACILITY Final Report

Apr. 1980 715 p refs

(Contract DE-AC03-76ET-28443)

(DOE/ET-28443/T1) Avail: NTIS HC A99/MF A01

In 13,000 hours of operation over a three and one half year period, the nominal 10 megawatt electrical equivalent GLEF provided the opportunity to identify problems in working with highly saline geothermal fluids and to develop solutions that could be applied to a commercial geothermal power plant producing electricity. A seven and one half year period beginning in April 1972, with early well flow testing and ending in September 1979, with the completion of extensive facility and reservoir operations is covered. During this period, the facility was designed, constructed and operated in several configurations. A comprehensive reference document, addressing or referencing documentation of all the key areas investigated is presented. DOE

N81-22564# Sandia Labs., Albuquerque, N. Mex.

SOLAR HEATING MATERIALS HANDBOOK: ENVIRONMENTAL AND SAFETY CONSIDERATIONS FOR SELECTION

Jan. 1981 275 p refs

(Contract DE-AC04-76DP-00789)

(DOE/TIC-11374) Avail: NTIS HC A12/MF A01

Properties are discussed for six classes of materials for solar heating systems: heat transfer fluids; glazing materials; insulation; seals and sealants; thermal storage media; and absorber materials. The properties important to the functioning of the material class are defined and discussed, and values for these properties are given for specific materials. Types of properties discussed include functional properties, compatibility properties, environmental response properties, hazardous properties, and environmental impact properties. A glossary and index are included. DOE

N81-22565# Kansas Energy Office, Topeka.

KANSAS HYDRO-POWER: AN ASSESSMENT OF LOW-HEAD HYDROELECTRIC OPPORTUNITIES

Thomas Hochstetler 2 Jan. 1981 26 p refs

(Contract DE-FG47-80R-701055)

(DOE/R7-01055/T1) Avail: NTIS HC A03/MF A01

The results of a recent survey of existing dams in Kansas to determine their respective development potentials for hydroelectricity generation are described. Of over 5000 dams in Kansas, 34 were found to have potential for commercial development based upon such parameters as head height, flow rate, seasonal flow variations, and present state of repair. These 34 sites together could potentially produce 394 million kilowatt hours of renewable resource derived electricity, about 1.5 percent of the electricity generated in Kansas in 1979. While statewide this would be a modest contribution, it could play an important role in local energy management. DOE

N81-22566# Radian Corp., Austin, Tex.

MATERIALS SELECTION GUIDELINES FOR GEOTHERMAL ENERGY UTILIZATION SYSTEMS

Peter F. Ellis, II and Marshall F. Conover Jan. 1981 489 p refs

(Contract DE-AC02-79ET-27026)

(DOE/RA-27026/1) Avail: NTIS HC A21/MF A01

Systems using geothermal energy in El Salvador, Iceland, Italy, Japan, Mexico, New Zealand, and the United States are described. The manual provides materials selection guidelines for surface equipment of future geothermal energy systems. The key chemical species that are significant in determining corrosiveness of geothermal fluids are identified. The utilization modes of

geothermal energy are defined as well as the various physical fluid parameters that affect corrosiveness. The application of various nonmetal materials in geothermal environments is discussed. Included in appendices are: corrosion behavior of specific alloy classes in geothermal fluids; corrosion in seawater desalination plants, worldwide geothermal power production; DOE sponsored utilization projects, plant availability; relative costs of alloys, and composition of alloys. DOE

N81-22567# Southern Methodist Univ., Dallas, Tex.
THIN FILM GALLIUM ARSENIDE SOLAR CELL RESEARCH Quarterly Report, 1 Sep. - 30 Nov. 1980
Shirley S. Chu Dec. 1980 31 p refs Sponsored in part by Midwest Research Inst.
(Contract EG-77-C-01-4042)
(SERI/PR-9002-3-T1; QR-3) Avail: NTIS HC A03/MF A01

Major efforts during this quarter were directed to: the optimization of the deposition of gallium arsenide films of 10 micro m thickness or less on tungsten/graphic substrates, the investigation of the effectiveness of various grain boundary passivation techniques, the deposition of tantalum pentoxide by ion beam sputtering as an antireflection coating, the deposition of gallium aluminum arsenide by the organometallic process, and the fabrication and characterization of large area Schottky barrier type solar cells from gallium arsenide films of about 10 micro m thickness. Various grain boundary passivation techniques, such as the anodic oxidation, thermal oxidation, and ruthenium treatment are investigated. DOE

N81-22568# Saugatuck Township Park and Recreation Commission, Mich.
SOLAR HEATING PANEL: PARKS AND RECREATION BUILDING, SAUGATUCK TOWNSHIP PARK AND RECREATION COMMISSION Final Report
4 Dec. 1980 11 p
(Contract DE-FG02-79R5-10127)
(DOE/R5-10127/2) Avail: NTIS HC A02/MF A01

The structure of the building is described. The process of insulating the structure is described. The design of the solar panel, headers and strong box full of rocks for heat storage is given complete with blueprints. The installation of the system is also described, including photographs of the solar panel being installed. Included is a performance report on this system by Purbolt's Inc., which describes measurements taken on the system and outlines the system's design and operation. Included also are 12 slides of the structure and the solar heating system. DOE

N81-22569# Colorado Univ., Boulder.
DIAGNOSTICS OF A GLOW DISCHARGE USED TO PRODUCE AMORPHOUS SILICON FILMS Progress Report, 15 Aug. - 14 Nov. 1980
A. Gallagher and James Scott 1980 6 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-9053-1-T2) Avail: NTIS HC A02/MF A01

Almost complete SiH4 dissociation has been obtained in approx. 950 C ovens between the turbo and rough pumps, so that reliable, long-term operation is achieved. The SiH4 inlet lines are entirely bakeable stainless steel and permanently closed to air, to maintain the tank purity of SiH4. The discharge configurations are shown, and the ratios of si sub x H sub n fluxes for three types of discharges in pure SiH4 are given. DOE

N81-22570# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
FUEL CELL APPLIED RESEARCH: ELECTROCATALYSIS AND MATERIALS Quarterly Report, 1 Oct. - 31 Dec. 1979
S. Srinivasan, H. S. Isaacs, J. McBreen, W. E. OGrady, H. Olender, L. J. Olmer, E. J. L. Schouler, and K. V. Kordesch May 1980 60 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51272) Avail: NTIS HC A04/MF A01

Five types of carbon were compared as supports for platinum electrocatalysts. Experiments were conducted to determine the wetting characteristics of the carbons on the electrocatalytic activity of supported platinum for oxygen reduction. The latter was investigated by a cyclic voltammetry technqiue. The changes in the electrochemically active surface areas on increasing the temperature from 250 to 1350C and after carrying out oxygen reduction were measured from the hydrogen desorption charge in the cyclic voltammograms. Also, research on electrode kinetics in high-temperature solid electrolyte fuel cells is described. The influence of electrode material on oxygen reduction kinetics and the reaction mechanism on platinum at interfaces with solid electrolytes were investigated. DOE

N81-22571# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE BASED ON TEST DATA: SUN-HEET NONTRACKING SOLAR COLLECTOR
Thomas D. Harrison Mar. 1981 23 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1964/4) Avail: NTIS HC A02/MF A01

The thermal performance predictions for the Sun-Heet nontracking, line-focusing parabolic trough collector at five cities in the US are presented. DOE

N81-22572# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE BASED ON TEST DATA: AAI SOLAR COLLECTOR WITH PRESSURE-FORMED GLASS REFLECTOR SURFACE
Thomas D. Harrison Mar. 1981 22 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1964/5) Avail: NTIS HC A02/MF A01

The thermal performance predictions for the AAI solar line focusing slat type collector for five cities in the US are presented. DOE

N81-22573# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE BASED ON TEST DATA: ACUREX SOLAR COLLECTOR WITH GLASS REFLECTOR SURFACE
Thomas D. Harrison Mar. 1981 25 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1964/6) Avail: NTIS HC A02/MF A01

The thermal performance predictions for the Acurex solar line-focusing parabolic trough collector for five cities in the US are presented. DOE

N81-22574# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE BASED ON TEST DATA: SOLAR KINETICS T-700 SOLAR COLLECTOR WITH GLASS REFLECTOR SURFACE
Thomas D. Harrison Mar. 1981 25 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1964/7) Avail: NTIS HC A02/MF A01

The thermal performance predictions for the Solar Kinetics solar line-focusing parabolic trough collector for five cities in the US are presented. DOE

N81-22575# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE BASED ON TEST DATA: ALPHA SOLARCO 104 SOLAR COLLECTOR WITH 0.125-INCH SCHOTT LOW-IRON GLASS REFLECTOR SURFACE
Thomas D. Harrison Apr. 1981 24 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1964/8) Avail: NTIS HC A02/MF A01

Thermal performance predictions based on test data are presented for the Alpha Solarco Model 104 solar collector, with a 0.125-inch Schott low-iron glass reflector surface, for three output temperatures at five cities in the United States. DOE

N81-22576# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
SYNFUEL PROGRAM ANALYSIS. VOLUME 1: PROCEDURES-CAPABILITIES
J. B. Muddiman and J. W. Whelan Jul. 1980 119 p refs 2 Vol.
(Contract DE-AC09-76SR-00001)
(DOE/RA-00001/T5-Vol-1) Avail: NTIS HC A06/MF A01

The analytic procedures and capabilities developed by

Resource Applications (RA) for examining the economic viability, public costs, and national benefits of alternative are described. This volume is intended for Department of Energy (DOE) and Synthetic Fuel Corporation (SFC) program management personnel and includes a general description of the costing, venture, and portfolio models with enough detail for the reader to be able to specify cases and interpret outputs. It contains an explicit description (with examples) of the types of results which can be obtained when applied for the analysis of individual projects; the analysis of input uncertainty, i.e., risk; and the analysis of portfolios of such projects, including varying technology mixes and buildup schedules. The objective is to obtain, on the one hand, comparative measures of private investment requirements and expected returns (under differing public policies) as they affect the private decision to proceed, and, on the other, public costs and national benefits as they affect public decisions to participate (in what form, in what areas, and to what extent). DOE

N81-22577# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
SYNFUEL PROGRAM ANALYSIS. VOLUME 2: VENVAL USERS MANUAL
J. B. Muddiman and J. W. Whelan Jul. 1980 145 p refs 2 Vol.
(Contract DE-AC09-76SR-00001)
(DOE/RA-00001/T5-Vol-2) Avail: NTIS HC A07/MF A01

This volume is intended for program analysts and is a users manual for the VENVAL model. It contains specific explanations as to input data requirements and programming procedures for the use of this model. VENVAL is a generalized computer program to aid in evaluation of prospective private sector production ventures. The program can project interrelated values of installed capacity, production, sales revenue, operating costs, depreciation, investment, dent, earnings, taxes, return on investment, depletion, and cash flow measures. It can also compute related public sector and other external costs and revenues if unit costs are furnished. DOE

N81-22578# Battelle Inst., Frankfurt am Main (West Germany). Hauptabteilung Chemie.
RESEARCH AND DEVELOPMENT IN THE FIELD OF SODIUM SULFUR BATTERIES: LONG LIFETIME BETA ALUMINA ELECTROLYTES PREPARED ACCORDING TO AN OPTIMIZED SPRAY DECOMPOSITION PROCESS Final Report
Reinhard Knoedler, Sonja Ammende, Hans-Peter Beck, Ruediger Klawik, Wolfgang Kuan, and Friedhelm Merz Bonn Bundesministerium fuer Forschung und Technologie Jul. 1980 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-032; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

An alternative process to solid state reaction of carbonates and oxides for the production of beta Al2O3 was established. The process involves thermal decomposition of nitrate solutions, i.e., spray decomposition. Ceramics of a fine-grained structure and with a homogeneous distribution of the components were then made from powders produced by this process. Tubes prepared from this powder show long lifetimes without degradation in Na/beta Al2O3/Na cells, even at current densities of up to 200 mA/sq cm. Author (ESA)

N81-22579# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
L-180 POSEIDON: A SYSTEM CONCEPT IN VERTICAL AXIS TURBINE TECHNOLOGY, PART 2
Olle Ljungstroem 9 Oct. 1980 33 p refs Presented at 3rd Intern. Symp. on Wind Energy Systems, Copenhagen, Aug. 1980
(Contract NE-5060-314)
(FFA-TN-AU-1577-Pt-2) Avail: NTIS HC A03/MF A01

An offshore 20MW L blade system with 180 m dia troposkien shaped blades was studied. The L-blade system uses two vertical, curved blades mounted on a cantilever tower at a 90 deg angle relative to each other (in plane of rotation), thus forming an L, looking from the top. Considerable reduction of the oscillating wind loads on the rotor-lower structure is realized in comparison with conventional two bladed Darrieus turbines resulting in reduced system weight and cost. Parking loads in extreme winds are also reduced favorably. Weight and cost estimates for farms of 10 or more offshore units are given. Author (ESA)

N81-22580# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
A COMPARISON OF RESULTS OBTAINED WITH TWO DIFFERENT METHODS FOR CALCULATION OF HORIZONTAL AXIS WIND TURBINE PERFORMANCE, PART 4
Staffan Meijer 6 Feb. 1980 31 p refs
(Contract NE-5061-013)
(FFA-TN-HU-2189-Pt-4) Avail: NTIS HC A03/MF A01

The turbine and flow field are described with finite element techniques. For the case of a wind turbine operating in steady uniform flow, performance and load characteristics were calculated and compared with the results from the standard computer program, WINRO, based on a combination of blade element and momentum theory. The calculations were made for a reference test case at different wind speeds. The reference unit is a 9 m radius two bladed 65 kW turbine. The results are in excellent agreement except for low wind speeds probably because three dimensional effects are more important for low wind speeds than for high. Author (ESA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-22581 Vanderbilt Univ., Nashville, Tenn.
THE REMOVAL AND MONITORING OF ENVIRONMENTAL POLLUTANTS Ph.D. Thesis
James Michael Brown 1980 125 p
Avail: Univ. Microfilms Order No. 8108269

The removal of manganese from waste waters by foam flotation was studied in a bench scale batch apparatus. Foam flotation of MnO2-Mn(OH)3 with Fe(OH)3 and NLS was tried, with incomplete conversion of Mn ++ to the highly insoluble MnO2. Flotation of MnCO3 with NLS and Fe(OH)3 was not as successfully as flotation of MnS with HTA and FeS. The foam flotation of MnS with HTA and CuS provided the best method of manganese removal with residual concentrations of manganese as low as 0.05 ppm. Adsorption of ideal and non ideal solutes was modeled into a single bead of macroreticular resin by solving the diffusion equation in spherical coordinates. The non ideal equations were solved numerically using a predictor corrector algorithm. Dissert. Abstr.

N81-22582 Pennsylvania Univ., Philadelphia.
THE FORMATION OF NOX FROM THE COMBUSTION IN A REFRACTORY PLUG FLOW BURNER OF HEXANE DROPLETS DOPED WITH NITROGEN AND SULPHUR COMPOUNDS Ph.D. Thesis
Shu-Kin Tang 1980 303 p
Avail: Univ. Microfilms Order No. 8107810

Moderate burning velocities are attained by stabilization of a premixed flame inside a refractory tube. Thermal feedback is by the following sequence: the hot downstream tube wall, which is heated convectively by the burned gas, transfers its energy back to the upstream wall by wall radiation and by thermal conduction in the wall. The upstream wall then heats the incoming reactants by convection. This mode of stabilization eliminates the backmixing of combustion products and reactants, producing a very thin and stable flame front, which is free os oscillations and nearly invisible. This combustion process has the distinct advantage over other combustion systems in that backmixing is minimal, and in the turbulent regime plug flow is approached. The complex combustion reaction kinetics can be modelled without diffusional or fluid mechanical complications. Dissert. Abstr.

N81-22583*# University of Central Florida, Orlando. Dept. of Biological Studies.
A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEM(STS) AT JOHN F. KENNEDY SPACE CENTER.

VOLUME 4: THREATENED AND ENDANGERED SPECIES OF THE KENNEDY SPACE CENTER. PART 1: MARINE TURTLE STUDIES Environmental Base Line Report, 1976 - 1979

L. M. Ehrhart 21 Aug. 1979 416 p refs 4 Vol.
(Contract NAS10-8986)
(NASA-CR-163122; KSC-TR-51-2-Vol-4-Pt-1) Avail: NTIS HC A18/MF A01 CSCL 13B

The status of marine turtle populations in the region of Kennedy Space Center is reported. Previous studies are reviewed and results of ground and aerial surveillance conducted between 1976 and April 1979 are presented. Species, tag number, weight, time discovered, activity at discovery, and location of discovery were recorded during ground surveillance. Observations were made on nesting and reproductive characteristics, population estimates, immigration and emigration, and growth rate of the turtles. Mortality studies were made and autopsies were performed on dead turtles found in the area. The population of sub adult marine turtles in the lagoons near Kennedy Space Center was investigated. J.D.H.

N81-22584*# University of Central Florida, Orlando. Dept. of Biological Sciences.

A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEM (STS) AT JOHN F. KENNEDY SPACE CENTER. VOLUME 4: THREATENED AND ENDANGERED SPECIES OF THE KENNEDY SPACE CENTER. PART 2: THREATENED AND ENDANGERED BIRDS AND OTHER THREATENED AND ENDANGERED FORMS Environmental Baseline Report, Sep. 1976 - Apr. 1979

L. M. Ehrhart 21 Aug. 1979 149 p refs 4 Vol.
(Contract NAS10-8986)
(NASA-CR-163122; KSC-TR-51-2-Vol-4-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 13B

The results of ground and aerial surveillance of thirty-seven species of birds from the state of Florida's list of endangered species found in the region of the Kennedy Space Center is reported. Numbers, species identity, nesting sites, and reproductive data were recorded and are combined with earlier data from the literature. A special study of launch Complex 39-B, near which is an excellent loafing and feeding site for many species, is presented. The results of surveillance of two species of snake, the gopher tortoise, the American alligator, the manatee, and the Florida mouse are also presented. J.D.H.

N81-22585# Council on Environmental Quality, Washington, D.C.

ENVIRONMENTAL QUALITY Annual Report

Dec. 1980 529 p refs
(AR-11) Avail: NTIS HC A23/MF A01

Major emphasis is placed on man environment interactions and environment management. Topics include: ecology and living resources; the global environment; water and air quality; toxic substances and environmental health; energy; natural resources; NEPA regulations; and land use. T.M.

N81-22586# Council on Environmental Quality, Washington, D.C.

CONTAMINATION OF GROUND WATER BY TOXIC ORGANIC CHEMICALS

Jan. 1981 101 p refs
Avail: NTIS HC A06/MF A01

Ground water contamination and its prevention are discussed in terms of industrial landfills, sewage disposal, mining and petroleum production. Contamination of drinking water wells is examined and results of several surveys included. Health risks associated with toxic organic chemicals found in drinking water wells are assessed. S.F.

N81-22587*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A DIAGNOSTIC MODEL FOR STUDYING DAYTIME URBAN AIR QUALITY TRENDS

Dana A. Brewer (George Washington Univ., Hampton, Va.), Ellis E. Remsberg, and Gerald E. Woodbury May 1981 43 p refs
(NASA-TP-1843; L-14251) Avail: NTIS HC A03/MF A01 CSCL 13B

A single cell Eulerian photochemical air quality simulation model was developed and validated for selected days of the 1976 St. Louis Regional Air Pollution Study (RAPS) data sets; parameterizations of variables in the model and validation studies using the model are discussed. Good agreement was obtained between measured and modeled concentrations of NO, CO, and NO2 for all days simulated. The maximum concentration of O3 was also predicted well. Predicted species concentrations were relatively insensitive to small variations in CO and NOx emissions and to the concentrations of species which are entrained as the mixed layer rises. T.M.

N81-22588*# Cramer (H.E.) Co., Inc., Salt Lake City, Utah.

DISPERSION MODEL STUDIES FOR SPACE SHUTTLE ENVIRONMENTAL EFFECTS ACTIVITIES Final Report, Mar. 1976 - Dec. 1980

Apr. 1981 126 p refs
(Contract NAS8-31841)
(NASA-CR-161721; TR-81-111-01) Avail: NTIS HC A06/MF A01 CSCL 13B

The NASA/MSFC REED computer code was developed for predicting concentrations, dosage, and deposition downwind from rocket vehicle launches. The calculation procedures and results of nine studies using the code are presented. Topics include plume expansion, hydrazine concentrations, and hazard calculations for postulated fuel spills. T.M.

N81-22589*# National Aeronautics and Space Administration, Washington, D. C.

ANNOYANCE CAUSED BY LIGHT AIRCRAFT NOISE

Mar. 1981 134 p refs Transl. into ENGLISH of "Stoerwirkungen Durch den Laerm der Kleinaviatik" Switzerland, Jun. 1980 p 1-132 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. fur Prazisorientierte Sozialforschung, Zurich, Switzerland and Mitwirkung der Eidg. Materialpruefungsanstalt, Dueden dorf, Switzerland
(Contract NASw-3198)
(NASA-TM-76533) Avail: NTIS HC A07/MF A01 CSCL 13B

The correlation between objective and noise stresses and subjectively perceived disturbance from general aviation aircraft was studied at 6 Swiss airports. Noise levels calculated for these airports are given. Survey results are analyzed. A.R.H.

N81-22590*# National Aeronautics and Space Administration, Washington, D. C.

THE ANNOYANCE CAUSED BY AIRPLANE NOISE IN THE VICINITY OF ORLY AIRPORT AND THE REACTION OF NEIGHBORING RESIDENTS

J. Francois Apr. 1981 16 p Transl. into ENGLISH of "La Gene Causee par le Bruit des Avions au Voisinage de l'Aeroport d'Orly et les Reactions des Riverains" Paris, Aug. 1972 15 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. Francais d'Opinion Publique, Paris
(Contract NASw-3199)
(NASA-TM-76575) Avail: NTIS HC A02/MF A01 CSCL 13B

General conclusions and the technical appendix of a report on the attitudes of people living near Orly Airport (Paris) toward airplane noise are presented. The noise was found to be very disruptive of residents' lifestyle and well being, although differences in perceived nuisance were noted. The factors inducing people to protest and who they blame for the present situation are discussed. It was found that the public image of protestors was generally positive and that people who did not protest were viewed as passive, uncaring, or else connected to aviation. A.R.H.

N81-22591*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

IN SITU CORRELATIVE MEASUREMENTS FOR THE ULTRAVIOLET DIFFERENTIAL ABSORPTION LIDAR AND THE HIGH SPECTRAL RESOLUTION LIDAR AIR QUALITY REMOTE SENSORS: 1980 PEPE/NEROS PROGRAM

Gerald L. Gregory, Sherwin M. Beck, and Joe J. Mathis, Jr. Apr. 1981 62 p refs
(NASA-TM-83107) Avail: NTIS HC A04/MF A01 CSCL 13B

In situ correlative measurements were obtained with a NASA aircraft in support of two NASA airborne remote sensors participating in the Environmental Protection Agency's 1980 persistent elevated pollution episode (PEPE) and Northeast regional oxidant study (NEROS) field program in order to provide data for evaluating the capability of two remote sensors for measuring mixing layer height, and ozone and aerosol concentrations in the troposphere during the 1980 PEPE/NEROS program. The in situ aircraft was instrumented to measure temperature, dewpoint temperature, ozone concentrations, and light scattering coefficient. In situ measurements for ten correlative missions are given and discussed. Each data set is presented in graphical and tabular format aircraft flight plans are included. A.R.H.

N81-22592*# National Aeronautics and Space Administration, Washington, D. C.

ON THE CORRELATION BETWEEN OBJECTIVE MEASUREMENTS AND SUBJECTIVELY FELT DISTURBANCE FROM TRAFFIC

Judith Lans May 1981 29 p Transl. into ENGLISH of "Ueber den Zusammenhang Zwischen Objektiven Messergebnissen und Subjektiv Empfundener Stoerung von Verkehrslaerm" Rept. Survey 3486/WS, Austria, 18 Mar. 1975 p 1-26 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Physik.-Tech. Versuchsanstalt fuer Waerme- und Schalltechnik und Technologishces Gewerbemuseum, Hohere Tech. Bundeslehr- und Versuchsanstalt, Berufspaedagogisches Inst. des Bundes, Vienna

(Contract NASw-3199)

(NASA-TM-75486) Avail: NTIS HC A03/MF A01 CSCL 13B

Measurements of traffic noise during the day were taken at 90 measurement points over the urban area of Vienna; in addition, the vehicle frequency ascertained at the individual measurement points was also noted. Results of these objective measurements or various characteristic single values derived from them are compared with the results of the environmental survey of 1973 on the subjective noise stress experienced within buildings but caused by outside factors. Suggestions for suitable measures to describe the traffic noise and to derive limit values are given considering the relationship between number of vehicles and noise and annoyance. J.M.S.

N81-22593*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF AIRPLANE NOISE ON THE INHABITANTS OF AREAS NEAR OKECIE AIRPORT IN WARSAW

Zbigniew Koszarny, Stefan Maziarka, and Wanda Szata May 1981 17 p refs Transl. into ENGLISH from Rocznik Panstwowego Zakladu Hygieny (Poland), v. 27, no. 2, 1976 p 113-121 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by National Inst of Hygiene, Warsaw

(Contract NASw-3198)

(NASA-TM-75879) Avail: NTIS HC A02/MF A01 CSCL 13B

The state of health and noise annoyance among persons living in areas near Okecie airport exposed to various intensities of noise was evaluated. Very high annoyance effects of airplane noise of intensities over 100 dB (A) were established. A connection between the airplane noise and certain ailments complained about by the inhabitants was demonstrated. A.R.H.

N81-22594*# National Aeronautics and Space Administration, Washington, D. C.

THE RELATIONSHIP BETWEEN NOISE AND ANNOYANCE AROUND ORLY

J. Francois and J. P. Roche May 1981 90 p Transl. into ENGLISH of 'Liaison dentre le bruit et la gene autour d'Orly" Paris, Jan. 1973 p 76 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. Francois d'Opinion Publique, Paris

(Contract NASw-3198)

(NASA-TM-76573) Avail: NTIS HC A05/MF A01 CSCL 13B

The extent to which annoyance estimated by an isopsophic index is a good forecaster for annoyance perceived near airport approaches was investigated. An index of sensed annoyance is constructed, and the relationship between the annoyance index and the isopsophic index is studied. A.R.H.

N81-22595# Argonne National Lab., Ill. Div. of Environmental Impact Studies.

STUDIES ON MATHEMATICAL MODELS FOR CHARACTERIZING PLUME AND DRIFT BEHAVIOR FROM COOLING TOWERS. VOLUME 5: MATHEMATICAL MODEL FOR MULTIPLE-SOURCE (MULTIPLE-TOWER) COOLING TOWER DRIFT DISPERSION Interim Report

A. J. Policastro, W. E. Dunn (Illinois Univ., Urbana), M. Breig, and K. Haake Jan. 1981 66 p refs Sponsored in part by EPRI

(Contract W-31-109-eng-38)

(EPRI-CS-1683-Vol-5) Avail: NTIS HC A04/MF A01

The multiple-source plume model is generalized to treat drift deposition as well. The basic ideas of drift modeling developed for single sources are the basis for the treatment of drift in this multiple-tower model. The treatment of droplet breakaway and the treatment of deposition of drift are easily generalized from single-source concepts. The model is tested with five sets of field data from the Pittsburgh, California mechanical-draft cooling towers (MDCTs). The data are the best available for multiple-sources yet these data have several weaknesses. In four of the five data surveys used to test the model, the model predicts sodium deposition rate within a factor of 3 at 50% of all ground samplers. DOE

N81-22596# Argonne National Lab., Ill. Energy and Environmental Systems Div.

MODELING APPROACH TO ASSESS THE IMPACT OF POINT SOURCE AIR POLLUTANT EMISSION ON VEGETATION

P. A. Dauzvardis, T. Veselka, and S. W. Ballou Sep. 1980 22 p refs Sponsored by DOE

(ANL/EES-TM-113) Avail: NTIS HC A02/MF A01

Dose response effects of gases emitted from industrial sources on vegetation were investigated. The techniques available for vegetation damage assessments are outlined. A method of assessing potential chronic and visible damage was developed and is described. Predictive models that estimate plant damage in terms of decreased yields and the geographic area exposed are developed. An example is presented in which the modeling techniques is used to determine the possible occurrence of yield reductions in crops grown near coal fired power plants. DOE

N81-22597# American Association for the Advancement of Science, Washington, D.C.

CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM. ENVIRONMENTAL AND SOCIETAL CONSEQUENCES OF A POSSIBLE CO2-INDUCED CLIMATE CHANGE: A RESEARCH AGENDA, VOLUME 1

Roger Revelle (California Univ., San Diego), Elise Boulding (Dartmouth College), Charles F. Cooper (San Diego State Univ.), Lester Lave (Brookings Inst.), Stephen H. Schneider (National Center for Atmospheric Research), and Sylvan Wittwer (Michigan State Univ., East Lansing) Dec. 1980 122 p

(Contract DE-AS01-79EV-10019)

(DOE/EV-10019/01-Vol-1) Avail: NTIS HC A06/MF A01

The research program is based on a recognition of the distinctive characteristics of the CO2 problem. It is concluded that three kinds of research on the consequences of rising levels research to enhance beneficial effects and lessen harmful ones, where this is possible, and to of atmospheric carbon dioxide and possible climatic changes are called for: assessemnt of risks; slow down rates of carbon dioxide emission; and study of potential social and institutional response to projected climatic changes. DOE

N81-22598# Public Service Electric and Gas Co., Newark, N. J.

COMPARATIVE EVALUATION OF EFFECTS OF OZONATED AND CHLORINATED THERMAL DISCHARGES ON ESTUARINE AND FRESHWATER ORGANISMS Final Report

C. R. Guerra, R. Sugam, J. W. Meldrim, E. R. Homstrom, and G. E. Balog Aug. 1980 138 p refs Prepared in cooperation with Ichthyological Associates, Inc., Middletown, Del.

(Contract DE-AC02-77EV-04384)

(DOE/EV-04384/T1) Avail: NTIS HC A07/MF A01

The feasibility of ozonation as an alternative to chlorination for control of biofouling in once through cooling systems was examined. The biological effects of ozonated and chlorinated thermal discharges were evaluated with estuarine and freshwater organisms. Mortality at salinities between 0.5 to 2.5 ppt with mummichog and white perch indicated greater toxicity for chlorine while the alewife, spottail shiner, rainbow trout, and white perch in freshwater were more sensitive to ozone. Behavioral and physographic results were consistent with those in toxicity studies. Initial cough response and avoidance concentrations of mummichog and white perch in estuarine waters were lower when exposed to chlorine than to ozone. In freshwater, blueback herring, alewife, rainbow trout, spottail shiner, banded killifish, and white perch avoided lower concentrations of ozone than chlorine. DOE

N81-22599# Physical Sciences, Inc., Woburn, Mass.
SYNTHETIC FUEL COMBUSTION. POLLUTANT FORMATION: SOOT INITIATION MECHANISMS IN BURNING AROMATICS Quarterly Report, 19 Sep. - 31 Dec. 1980
W. T. Rawlins and T. Tanzawa Jan. 1981 33 p refs
(Contract DE-AC22-80PC-30292)
(DOE/PC-30292/1) Avail: NTIS HC A03/MF A01

The design and configuration of the experimental apparatus are described. The details of a kinetic model are outlined, and possible reaction pathways are discussed. The experiments are performed in a shock tube over the temperature range 1300 to 2500 K, using multiple ultraviolet, visible, and infrared diagnostics to monitor the kinetic behavior of free radicals (such as OH), incipient soot particles, and combustion products. Experiments are conducted with artificially enhanced concentrations of free radicals such as OH and O to determine their effects on the kinetics of soot and soot precursors. DOE

N81-22600# California Univ., Livermore. Lawrence Livermore Lab.
MODEL FOR FORECASTING THE EFFECTS OF SO2 POLLUTION ON GROWTH AND SUCCESSION IN A WESTERN CONIFEROUS FOREST
J. R. Kercher and M. C. Axelrod 6 Jan. 1981 65 p refs
(Contract W-7405-eng-48)
(UCID-18537) Avail: NTIS HC A04/MF A01

The model simulates growth including the development in time of dbh, height, leaf area index, and available light for each tree. Recruitment and mortality are modeled stochastically. Modifications include the introduction of fire ecology and the use of temporal seed crop patterns and seedling survival factors unique to Sierra Nevada forests. The model simulates community dynamical and structural response to many factors quite well. To investigate effects of low level chronic SO2 fumigation, the pollutant level was set to cause annual leaf area damage of 5% for SO2-sensitive species and 0.6% in tolerant species. This generates a 10% reduction in growth for P. ponderosa, 18% reduction in growth for Pseudotsuga menzlisii, and approximately 2% to 1% reduction for SO2 tolerant species such as A. concolor. DOE

N81-22601# Department of Energy, Washington, D. C. Regional Impacts Div.
MATRIX METHODS TO ANALYZE LONG-RANGE TRANSPORT OF AIR POLLUTANTS
Richard H. Ball, Jay Arnold (The Aerospace Corp.), A. Bruce Crane (The Aerospace Corp.), Ronald E. Meyers (Brookhaven National Lab.), Lawrence Kleinman (Brookhaven National Lab.), Thomas Carney (Brookhaven National Lab.), William J. Eadie (Battelle Pacific Northwest Lab.), and William E. Davis (Battelle Pacific Northwest Lab.) Jan. 1981 119 p refs
(DOE/EV-0127) Avail: NTIS HC A06/MF A01

Development of the air transport matrix method was undertaken to assess air quality constraints and impacts of energy activities. The method represent results of comprehensive long range transport models in a simple, easy to use form. The concept and methodologies used in developing matrices, a preliminary analysis of those matrices and their properties, and a guide to the types of applications they can serve are presented. Matrices were generated for transport of sulfur oxide emissions among the 238 Air Quality Control Regions (AQCR) in the contermin-ous United States, using the AIRSOX model. The long range transport model and a streamlined calculation method were used to generate matrices for sulfur oxides and for emitted fine particulates. Matrices were also completed for 4 months of meteorological data (one in each season) from 1974. Matrices are separated according to three categories of sources: utility, industrial, and area sources. They differ in terms of effective stack heights and detailed distribution of source locations within each AQCR. Matrices have also been calculated at the more aggregated levels of state and Federal region boundaries. DOE

N81-22602# Battelle Pacific Northwest Labs., Richland, Wash.
MASS-CONSISTENT MODELING, REVISED
R. L. Drake Jul. 1980 19 p refs
(Contract DE-AC06-76RL-01830)
(PNL-SA-8789-Rev) Avail: NTIS HC A02/MF A01

The concepts and interpretation of mass-consistent modeling for wind fields over complex terrain are summarized. The conclusion is that interpolation of measured winds over an area are more important than making them mass-consistent. Hence, an interpolation scheme is proposed that is automatically mass consistent if vertical winds are only produced by adjusting the vertical wind component in a transformed coordinate system. DOE

N81-22603# Battelle Pacific Northwest Labs., Richland, Wash.
CLOUDS, PRECIPITATION AND AIR QUALITY
B. C. Scott Dec. 1980 40 p refs
(Contract DE-AC06-76RL-01830)
(PNL-SA-9056) Avail: NTIS HC A03/MF A01

Basic mathematical concepts for treating problems in precipitation scavenging are presented along with improved terminology suggestions. Emphasis of gas and aerosol removal is on surface deposition. The suspected properties of organics and metals and relation of those properties to wet removal by precipitation are discussed. Some discussion is also included for wet removal of SO2 from the atmosphere. DOE

N81-22604# Los Alamos Scientific Lab., N. Mex.
ENVIRONMENTAL AND RADIOLOGICAL SAFETY STUDIES: INTERACTION OF 238PuO2 HEAT SOURCES WITH TERRESTRIAL AND AQUATIC ENVIRONMENTS Progress Report, 1 Jul. - 30 Sep. 1980
Glenn R. Waterbury, comp. 30 Sep. 1980 45 p refs
(LA-8664-PR) Avail: NTIS HC A03/MF A01

The containers for 238PuO2 heat sources in radioisotope thermoelectric generators are designed with large safety factors to ensure that they will withstand reentry from orbit and impact with the Earth and safely contain the nuclear fuel until it is recovered. The effects on the heat source of terrestrial and aquatic environments are studied to obtain data for design of safer systems. The data obtained in several ongoing experiments are presented. Compilations of usable data generated in each experiment are emphasized. These compilations include data from environmental chamber experiments that simulate terrestrial conditions, experiments to measure PuO2 dissolution rates, soil column experiments to measure sorption of plutonium by soils, and several aquatic experiments. S.F.

N81-22605# TRC Environmental Consultants, Inc., Wethersfield, Conn.
METEOROLOGICAL AND AIR QUALITY DATA, WIPP SITE: EDDY COUNTY, NEW MEXICO Quarterly Report, Dec. 1977 - Feb. 1978
L. P. Pocalujka, E. Babij, P. A. Catizone (Sandia National Labs.), and H. W. Church Nov. 1980 27 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7160) Avail: NTIS HC A03/MF A01

The purpose of the Waste Isolation Pilot Plant meteorological, air quality, and radiological measurements program was to support the environmental effort for the evaluation of the site suitability. This is the latest in a series of seasonal quarterly data summaries to be issued for the southeastern New Mexico site. Author

N81-22606# Acurex Corp., Mountain View, Calif.
ADVANCED PULVERIZED COAL COMBUSTOR FOR CONTROL OF NO/SUB x/ EMISSIONS Quarterly Report, 24 Sep. - 24 Dec. 1980

R. Pam, E. K. Chu, and J. T. Kelly 30 Jan. 1981 51 p refs (Contract DE-AC22-80PC-30296)
(DOE/PC-30296/1; QR-1) Avail: NTIS HC A04/MF A01

A preliminary gas phase reaction model for predicting fuel NO sub x formation during combustion of methane fuel was constructed. Predictions of NO sub x formation under stirred reactor conditions agree with existing experimental data. Progress was made in formulating the changes necessary to upgrade the Acurex PROF code for use as the comprehensive data analysis tool in this program. The idealized combustor was designed, and requests for bids to fabricate the combustor were submitted. DOE

N81-22607# Department of Energy, Washington, D. C. Office of Environmental Compliance and Overview.
SEACOST TEST FACILITY, STAGE 1: ENVIRONMENTAL ASSESSMENT
Nov. 1980 77 p refs
(Contract W-31-109-eng-38)
(DOE/EA-0121) Avail: NTIS HC A05/MF A01

The facility will withdraw a nominal 1890 L/s (500 gpm) of surface seawater from the ocean adjacent to the site for use in biofouling and corrosion control experiments critical to Ocean Thermal Energy Conversion (OTEC) development. The used water will be discharged to the land, and will flow toward and eventually enter the Class AA ocean waters adjacent to the site. No biocides of any kind will be used during the initial experiments at STF 1, and no NPDES permit will be required for discharges during these experiments. Following the initial experiments, chlorine will be used at STE 1, and a NPDES permit (or exemption) will be sought for the discharge of small amounts of chlorinated water from STF 1. DOE

N81-22608# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ENVIRONMENTAL REGULATIONS: APPLICABILITY TO ADVANCED PHOTOVOLTAIC CONCEPTS
D. A. Schaller Jan. 1981 15 p refs Presented at 7th Natl. Conf. on Energy and the Environ., Phoenix, Ariz.
(Contract DE-AC02-77CH-00178)
(SERI/TP-743-1027; CONF-801171-1) Avail: NTIS HC A02/MF A01

Federal environmental, health, and safety programs related to the manufacturing of Cu2S/CdS solar cells are discussed. Air quality, occupational health, water quality, solid and hazardous wastes, and occupational safety related to the fabrication of Cu2S/CdS solar cells are discussed. DOE

N81-22609# Wyoming Univ., Laramie. Dept. of Geology.
PUSH-PULL TEST: A METHOD OF EVALUATING FORMATION ADSORPTION PARAMETERS FOR PREDICTING THE ENVIRONMENTAL EFFECTS ON IN SITU COAL GASIFICATION AND URANIUM RECOVERY
J. I. Drever and C. R. McKee Nov. 1980 30 p refs Prepared in cooperation with In situ Consulting, Laramie, Wyo.
(DOE/TIC-11383) Avail: NTIS HC A03/MF A01

The push-pull test, which is a simple injection and pumping sequence of groundwater spiked with solutes of interest, is presented as a method of determining the adsorption characteristics of a formation. Adsorption properties are necessary to predict restoration from both in situ coal gasification and in situ uranium extraction. Two field push-pull tests were conducted on uranium formations in Wyoming. Adsorption properties estimated from these tests on the basis of a simple cell model were compared to the laboratory values. In the first case, excellent agreement was observed between the values estimated from the field test and the values measured in the laboratory. In the second case, the value determined in the laboratory was five times higher than the field value. It is recommended that push-pull tests be conducted on coal formations being considered for in situ gasification in view of the great uncertainty in extrapolating laboratory adsorption properties to the field. DOE

N81-22610# Babcock and Wilcox Co., Barberton, Ohio.
CONTROL OF NO SUB x EMISSIONS AT A 220-MW COMBINED-CYCLE POWER PLANT Final Report
G. V. Brechum, E. J. Campobenedetto, D. W. Anacki, P. L. Langsjoen, L. J. Muzio, and R. E. Thompson Nov. 1980 113 p refs Prepared in cooperation with KVB, Inc., Irvine, Calif. Sponsored by Electric Power Research Inst.
(EPRI Proj. 782-1)
(EPRI-CS-1608) Avail: NTIS HC A06/MF A01

A field test program was conducted to determine the NO sub x characteristics of a 220 MW supplementary fired unit. A primary objective was to determine the fraction of the gas turbine generated NO sub x that can potentially be reduced upon passage through the combustion zone of the boiler. The boiler was operated in a low NO sub x staged combustion configuration by removing selected burners from service. The baseline NO sub x emissions from the combined cycle system were found to be substantially lower than the NO sub x emissions from the boiler alone when operated with ambient air supplied by forced draft fans. DOE

N81-22611# Electric Power Research Inst., Palo Alto, Calif. Energy Analysis and Environment Div.
REGIONAL AIR-QUALITY STUDIES: THE NEEDS AND THE PRIORITIES
G. R. Hilst Feb. 1981 70 p refs
(EPRI-EA-1650-SR) Avail: NTIS HC A04/MF A01

Four topical research problems are addressed. They are SO/sub x//NO/sub x/chemistry, acidic precipitiation, trace elements and fine particles, and visibility. The analysis and planning includes an identification of research needs common to all four areas as well as specialized research requirements. The results take the form of an examination of the research required to meet the electric utility industry's needs, and a priority ordering of this research during the next five years. The large regional measurements projects that have characterized regional air quality studies projects to date should be gradually diminished (but not eliminated) in favor of a more nearly balanced program of theorectical, laboratory, and analytical efforts. DOE

N81-22612# Los Alamos Scientific Lab., N. Mex.
ENVIRONMENTAL ASSESSMENT OF TRACE ELEMENTS FROM COAL COMBUSTION IN THE SEMIARID WEST, SUMMARY REPORT FOR FY 1976 - 1979 Progress Report
L. E. Wangen and D. R. Dreesen Feb. 1981 23 p refs
(Contract W-7405-eng-36)
(LA-8660-MS) Avail: NTIS HC A02/MF A01

The two major goals are to: identify potentially hazardous trace elements in stack emissions and assess their importance with respect to deposition onto surrounding terrain, and to determine which elements are mobilized in the scrubber system and ash disposal ponds at the power plant. Results of dry deposition calculations, trace element measurements in air particulate, soils, and vegetation are reported pursuant to the first goal. Trace elements extracted from fly ash, trace element measurements in influent and effluent waters of the power plant, and trace element concentrations in a specie of vegetation growing in these effluent water channels are reported pursuant to the second goal. DOE

N81-22613# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Feb. 1981 237 p Prepared for Argonne National Lab., Ill.
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-81-02) Avail: NTIS HC A11/MF A01

Available meteorological data for reporting sites in National Solar Data Network are presented as follows: the insolation table presents the total, diffuse, direct, maximum, and extra terrestrial radiation for the solar site; the temperature table gives the average, daytime, nighttime, maximum, minimum, and inlet water temperatures for the solar site. Wind speed and direction and relative humidity values for day and night are presented also. DOE

N81-22614# Gulf Research and Development Co., Pittsburgh, Pa. Chemicals and Minerals Div.
EFFECTS OF COMPONENTS OF SYNFUELS ON SOOT FORMATION Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1980
J. E. Haebig and P. M. Goldberg Feb. 1981 14 p refs Prepared for Pittsburg Energy Technology Center

(Contract DE-AC22-80PC-30307)
(DOE/PC-30307/T1; Rept-627RM053; QTPR-1) Avail: NTIS HC A02/MF A01

The relationship between the rate and amount of soot formation in the combustion of coal-derived synfuels and the chemical composition and molecular constituent of those fuels is addressed. Scoping tests were performed on components of the testing system to check their usability with higher boiling fuel oil components. The required temperature and residence times for a fuel vaporizer (to precede the burner) were determined, and the fuel and air feed velocity zones for flame stability and incipient soot formation were observed in a prototype flat flame burner for several hydrocarbons and kerosene. Also, the design of the pressurized burner enclosure and flow/safety systems is described. DOE

N81-22615# Argonne National Lab., Ill. Div. of Environmental Impact Studies.
STUDIES ON MATHEMATICAL MODELS FOR CHARACTERIZING PLUME AND DRIFT BEHAVIOR FROM COOLING TOWERS. VOLUME 1: REVIEW OF EUROPEAN RESEARCH
A. J. Policastro and M. Wastag Jan. 1981 185 p refs Sponsored by Electric Power Research Inst. 4 Vol.
(Contract W-31-109-eng-38; EPRI Proj. 906-1)
(EPRI-CS-1683-Vol-1) Avail: NTIS HC A09/MF A01

Laboratory and field data available to aid in the validation and improvement of cooling tower plume models are reviewed. These data include basic parametric information on plume dispersion from one, two, and four towers of natural draft type, visible plume field data, and measurements at tower exit of liquid water emission rates, droplet size spectra, and temperature/velicity profiles. Velocity and temperature profiles across the tower top which reveal several distinct flow configurations depending on the wind speed at tower top are included. Existing European models for cooling tower plume dispersion are also reviewed. Two of the most popular models (KUMULUS and FOG) are tested with field data and found to perform on par with the better US models. A two year climatological study at Niederaussem presented interesting information on the long term physical and biological effects of the cooling towers. A study of bacterial emissions of cooling towers using waste water revealed no significant adverse effects at and in the vicinity of the cooling towers. DOE

N81-22616# Argonne National Lab., Ill. Dept. of Mechanical and Industrial Engineering.
STUDIES ON MATHEMATICAL MODELS FOR CHARACTERIZING PLUME AND DRIFT BEHAVIOR FROM COOLING TOWERS. VOLUME 2: MATHEMATICAL MODEL FOR SINGLE SOURCE (SINGLE TOWER) COOLING TOWER PLUME DISPERSION
R. A. Carhart, A. J. Policastro, S. Ziemer, K. Haake, and W. E. Dunn Jan. 1981 185 p refs Sponsored by Electric Power Research Inst. 4 Vol.
(Contract W-31-109-eng-38; EPRI Proj. 906-1)
(EPRI-CS-1683-Vol-2) Avail: NTIS HC A09/MF A01

An improved model for natural draft cooling tower plumes from single towers is presented. The model was developed through careful study of the systematic behavior of existing laboratory and field data and systematic testing of theoretical assumptions commonly employed in available plume models. Major model assumptions include bent over plume; different spreading rates for momentum, temperature, and moisture; and an empirical treatment for plume downwash. Unknown experimental coefficients in the model were determined through calibration of model predictions with single phase laboratory and visible plume field data. The model was also verified with new data not used in the calibration process. The model provides an improvement in theory and performance over existing models and provides a contract representation of plume behaving at large wind speeds. DOE

N81-22617# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
STUDIES ON MATHEMATICAL MODELS FOR CHARACTERIZING PLUME AND DRIFT BEHAVIOR FROM COOLING TOWERS. VOLUME 3: MATHEMATICAL MODEL FOR SINGLE SOURCE (SINGLE TOWER) COOLING TOWER DRIFT DISPERSION
W. E. Dunn Jan. 1981 249 p refs Prepared in cooperation with Argonne National Lab., Illinois Sponsored by Electric Power Research Inst. 4 Vol.
(Contract W-31-109-eng-38; EPRI Proj. 906-1)
(EPRI-CS-1683-Vol-3) Avail: NTIS HC A11/MF A01

A salt drift deposition model for single natural draft cooling towers which has the advantages of improved theory and good performance with field data is presented. Advantages to the model include: a submodel for cooling tower plume rise which was calibrated and validated with laboratory and field data; improved treatment of droplet evaporation which accounts for salt concentration gradients within the drop; and an option to employ a drop breakaway criterion which allows a more continuous transition between plume and ambient environments for the drop. The model is untested for distances greater than 1.0 km due to the lack of good quality field data at those distances. The model was developed as an improvement over existing theories which are evaluated theoretically and tested with Chalk Point data. Sensitivity studies are presented which provide considerable insight as to the differences among existing formulations for droplet evaporation and droplet breakaway methods. DOE

N81-22618# Argonne National Lab., Ill. Div. of Environmental Impact Studies.
STUDIES ON MATHEMATICAL MODELS FOR CHARACTERIZING PLUME AND DRIFT BEHAVIOR FROM COOLING TOWERS. VOLUME 4: MATHEMATICAL MODEL FOR MULTIPLE SOURCE (MULTIPLE TOWER) COOLING TOWER PLUME DISPERSION
A. J. Policastro, R. A. Carhart, and M. Wastag Jan. 1981 165 p refs Sponsored by Electric Power Research Inst. 4 Vol.
(Contract W-31-109-eng-38; EPRI Proj. 906-1)
(EPRI-CS-1683-Vol-4) Avail: NTIS HC A08/MF A01

A generalization of the single source model to multiple sources is presented. The generalized model can treat vapor plume dispersion from any number of cooling towers in any geometrical configuration in any orientation to the direction of the wind. Important characteristics of the model include: (1) methodology of plume merging which accounts for differing plume entrainment rates during merging depending on wind direction; and (2) treatment of the effects of tower downwash from multiple towers; namely, additional entrainment and an additional pressure drag force acting vertically. Limited calibration of the model to laboratory data was undertaken to determine two downwash coefficients. Verification of the model by comparing model predictions to lab and field data revealed a superior performance of the model as compared to the models commonly used in environmental impact evaluation. The ANL multiple source model predicts visible plume height within a factor of 2 and/or visible plume length within a factor of 2 1/2 in 80% of the field data test cases. DOE

N81-22619# Bristol Univ. (England). Dept. of Aeronautical Engineering.
A STUDY OF THE INITIAL PLUME DEVELOPMENT FROM TRIANGULAR CONFIGURATIONS OF MULTIPLE STACKS B.S. Thesis
S. P. Godden and R. J. Warren Jun. 1980 62 p refs
(BU-249) Avail: NTIS HC A04/MF A01

A detailed investigation was carried out for a comprehensive range of cases for a tunnel/efflux velocity ratio of 1:1.5; cases were also studied for the ratio 1:2.4. Helium introduced into the plume as a tracer gas was detected by a mass spectrometer. For zero stack separation, the plume gave plume rise with considerable downward dispersion in the wake, similar to a larger stack delivering the same mass flow rate at the same efflux velocity. Increasing stack separation to one and two stack diameters produced increases in plume rise and greater dispersion towards ground level in the wake of the stacks. Author (ESA)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-22620 California Univ., Santa Barbara.
MAGMATISM AT AN OCEANIC SPREADING-RIDGE EXAMPLES FROM THE SAMAIL OPHIOLITE, OMAN Ph.D. Thesis
John Stith Pallister 1980 375 p
Avail: Univ. Microfilms Order No. 8107703

Field, petrologic, and geochemical characteristics of the crustal suite of the Samail ophiolite, exposed in the southeastern Oman Mountains, reveal the magmatic history of a segment of Cenomanian Tethyan oceanic lithosphere. Structural data from the sheeted-dike complex allow reconstruction of a paleo-spreading ridge axis of 345 deg declination, indicating a maximum spreading width of 275 km for the entire ophiolite nappe. Chill-margin relations from the dike complex indicate multiple parallel intrusion from a narrow intrusion zone that probably oscillated about the spreading axis. Disequilibrium metamorphic assemblages in dikes are attributed to 'retrograde' sub-seafloor hydrothermal metamorphism during migration away from the paleo-ridge axis. In spite of alteration, major, minor, and trace element chemistry of dike samples still show a primary magmatic differentiation trend attributed to 'wet' fractionation of tholeiitic melt. Sparse diabase dikes intrude both the mantle (peridotite tectonite) section of the ophiolite and the metamorphic sole; but do not cut the underlying allochthonous and autochthonous rocks, indicating emplacement during ophiolite obduction. Dissert. Abstr.

N81-22621 Texas A&M Univ., Galveston.
GEOCHEMISTRY OF DISSOLVED GASES IN THE HYPERSALINE ORCA BASIN Ph.D. Thesis
Denis Alan Wiesenburg 1980 282 p
Avail: Univ. Microfilms Order No. 8108062

Hypersaline, anoxic waters affect the biogeochemistry of dissolved gases in the Orca Basin (northern Gulf of Mexico). The high stability of the Orca brine pool is used for studying production and consumption of dissolved gases during anaerobic decomposition. Depth distributions were determined for nitrogen, oxygen, argon, methane, propane, ammonia, hydrogen sulfide, and nitrous oxide. Physical stratification of the water column strongly influences Orca Basin gas distributions. The high salinity brine is internally well mixed due to convective overturning, but transfer across the brine sea water interface is controlled by molecular diffusion. The high stability of the brine (due to increased density) prevents either reactants or products of anaerobic decomposition from escaping by other than molecular processes. Concentrations of biogenic methane and ethane are higher there than in any other anoxic marine basin. Rates of microbial activity are generally slower in the hypersaline Orca Basin. Dissert. Abstr.

N81-22622 Arizona State Univ., Tempe.
A COMPARATIVE EVALUATION OF HOURLY SOLAR GLOBAL IRRADIATION MODELS Ph.D. Thesis
Gary Luther Powell 1980 256 p
Avail: Univ. Microfilms Order No. 8107068

Identification of models that use routinely measured meteorological variables to estimate solar global irradiation on an hourly basis. Comparative evaluation of the performance of those models using a relatively large set of hourly solar and collateral meteorological data, and development of an improved hourly solar global model that can be applied at as many sites as possible are discussed. The history of attempts to model solar irradiation from meteorological variables are reviewed and five models that use routinely measured data to estimate solar global irradiation on an hourly basis are described in detail. Four of the models are intercompared using NOAA data from 1977 and a wide variety of statistical evaluation techniques. Dissert. Abstr.

N81-22623 Pennsylvania State Univ., University Park.
A PALYNOLOGICAL INVESTIGATION OF POSTGLACIAL SEDIMENTS AT TWO LOCATIONS ALONG THE CONTINENTAL DIVIDE NEAR HELENA, MONTANA Ph.D. Thesis
Lynn Alvin Brant 1980 172 p
Avail: Univ. Microfilms Order No. 8107544

Cores of sediments from two marshes in the mountains along the Continental Divide near Helena, Montana were obtained with a piston corer. Closely spaced subsamples were processed and analyzed for pollen in an effort to decipher postglacial vegetation history, long term effects of the Mazama ash fall, and the history of the two sites. The marshes were once ponds which filled with glacial rock flour and other terrigenous sediment, diatom frustules, organic material, and volcanic ash. Two volcanic events recorded in the sediment are, presumably, the Glacier Peak eruption of about 12,000 years B.P. and the Mazama eruption of about 6600 years B.P. Alphine tundra, which occupied the mountains shortly after deglaciation, was replaced, first, by transitional vegetation, then by the extant coniferous forest. Palynological diversity and polynomorph concentration were used to distinguish five successive sedimentary environments which produced the different kinds of sediment filling one of the original ponds. Dissert. Abstr.

N81-22624 Utah Univ., Salt Lake City.
THERMAL STUDIES IN A GEOTHERMAL AREA Ph.D. Thesis
Wesley Raphiel Wilson 1980 156 p
Avail: Univ. Microfilms Order No. 8106881

Interpretation of heat flow data is divided into three parts: (1) a field study at Roosevelt Hot Springs, Utah which demonstrates how the heat flow map is developed and how it can be enhanced to determine deep reservoir geometry; (2) a technique for interpreting a heat flow profile traversing a fault where fluids are constrained to flow along the fault plane; and (3) a method for correcting heat flow measurements made on an arbitrary surface to a constant elevation datum plane. Temperature profiles and heat flow values were determined for 53 drill holes within the Roosevelt Hot Springs KGRA (Known Geothermal Resource Area), Utah. The temperature profiles can be classified in three spatially consistent patterns on the basis of their thermal gradient value. These patterns delineate hydrologic recharge, active convection, and discharge regions respectively. Dissert. Abstr.

N81-22625 Wisconsin Univ. - Madison.
GEOPHYSICAL-GEOLOGICAL EXPLORATION FOR OFFSHORE SAND AND GRAVEL, WESTERN LAKE MICHIGAN Ph.D. Thesis
Carol Jean Jigliotti Welkie 1980 188 p
Avail: Univ. Microfilms Order No. 8028215

Assessment of sand and gravel resources in western Lake Michigan is a contribution to remote sensing methodology for efficiently locating and estimating the volume of subaqueous deposits. Four inexpensive and rapid geophysical profiling methods were tried in order to determine continuously the variability of sediments along profiles and at depth: high resolution acoustic profiling, resistivity profiling, seismic refraction, and resistivity sounding. The latter two methods were modified to approach continuous data acquisition along profiles. Based upon the geophysical data, samples were taken at representative locations to provide verification of sediment type and an indication of the quality of deposits found. Three sites, examined 1977-78, were selected because they were adjacent to known onshore deposits, were near high-use urban centers, and in one case, offshore sands had previously been sampled surficially and cored. Dissert. Abstr.

N81-22626 Texas A&M Univ., Galveston.
UNIAXIAL AND CONTROLLED-LATERAL STRAIN TESTS ON SELECTED SEDIMENTARY ROCKS Ph.D. Thesis
James Aloysius Rigert 1980 417 p
Avail: Univ. Microfilms Order No. 8108040

Cylindrical specimens of several sandstones, carbonates, and quartz-rich siltstones, exhibiting a wide range of porosites, were deformed in a computer-controlled hydraulic loading apparatus and were loaded with axial stresses up to 400 MPa under conditions of uniaxial strain or limited lateral expansion. The resulting differential stresses lead to partially inelastic behavior arising from cataclastic processes and intragranular flow. Deviations from elasticity depend strongly on composition,

cementation, and porosity. Rocks with a strong structural framework show the least deviation. Published measurements of in-situ stress in stable sedimentary basins indicate much lower differential stresses than those found in uniaxial-strain tests. The effects of pore pressure may lessen this gap. Tests here are dry short-term tests and neglect time-dependent relaxation processes as well as possible slip along faults found in a region the size of a basin. The large differential stresses reached in uniaxial-strain tests would cause slip along favorably oriented faults in sandstones, but not in porous limestones or clay-rich siltstones. Dissert. Abstr.

N81-22627 California Univ., Santa Barbara.
THE ORIGIN OF BIMODAL VOLCANISM, WEST-CENTRAL ARIZONA Ph.D. Thesis
Neil Hedner Suneson 1980 326 p
Avail: Univ. Microfilms Order No. 8108076

Tertiary volcanic rocks in the Castaneda Hills and northwestern part of the Artillery Peak 15' quadrangles, west-central Arizona, are interbedded in predominantly continental clastic sedimentary rocks and minor limestone. Gravity glide blocks composed of Paleozoic limestone and quartzite and Precambrian granitic rocks and a monolithologic megabreccia composed dominantly of fragments of Mesozoic metavolcanic rocks are also interbedded in the sedimentary sequence. The sediments accumulated in northwest-trending normal fault-controlled basins. The normal faults are mostly high-angle to the northeast but are low-angle listric faults to the southwest. The inverse stratigraphy represented by the megabreccia and glide block rock types indicates progressive tectonic denudation of the plastically attenuated and mylonitized gneiss of the Harcuvar metamorphic core complex, first by coalescence of listric faults to form the Rawhide Mountains detachment fault, then by free-glide gravity gliding. Additional findings are detailed and conclusions are drawn. Dissert. Abstr.

N81-22628 Washington Univ., Seattle.
AN IMPROVED DETERMINATION OF THE INTERNAL BETA-RAY DOSE-RATE IN GRANITE ROCKS AND ITS EFFECT ON THERMOLUMINESCENCE DATES Ph.D. Thesis
Anthony Louis Plachy 1980 347 p refs
Avail: Univ. Microfilms Order No. 8102696

The dose is due primarily to the potassium 40 contained in the other minerals in the rock. The purpose of improving the dosimeter determination is to produce thermoluminescence (TL) dates of sufficient accuracy that they can be used to calibrate radiocarbon dates beyond 7000 years before present. To accurately determine the dose rate, a matrix representation of the rock is made using color photography of the cathodoluminescence (CL) from polished rock sections to identify and map the minerals. This matrix is the input data for a FORTRAN IV computer program which finds the quartz points and then determines the average distribution of minerals about the quartz points. This is combined with beta ray dosimetry data and the potassium 40 concentrations of the various minerals to yield the dose rate. Dissert. Abstr.

N81-22629# North Carolina State Univ. at Raleigh.
THE FIBRE BUNDLE AND HOLONOMY GROUP STRUCTURE OF GRAVITATION AND OTHER GAUGE THEORIES Ph.D. Thesis
Larry Keith Norris 1980 267 p
Avail: Univ. Microfilms Order No. 8100806

The development of the structure of these theories proceeds in essentially two related directions. In one direction, certain aspects of the role of the holonomy groups, especially the infinitesimal holonomy groups (IHG), in standard Einstein gravitational theory were developed and its extensions in terms of the bundle of linear frames over spacetime were clarified. The basic fiber bundle features of these theories is extended to more general bundles over spacetime so as to be able to deal with generalized theories of gravitation. Dissert. Abstr.

N81-22630 California Univ., San Diego.
THE ROLE OF ACOUSTIC-GRAVITY WAVES IN GENERATING EQUATORIAL IONOSPHERIC IRREGULARITIES Ph.D. Thesis
Paul Emmett Argo 1980 175 p
Avail: Univ. Microfilms Order No. 8107453

The spatial resonance amplification of traveling ionospheric disturbance (TIDs) generated by acoustic gravity waves was studied. As the wave profile in the plasma steepens, the stored energy begins to release through the Rayleigh-Taylor instability, which then creates a spectrum of smaller scale irregularities. The interaction of the acoustic gravity wave and the ionospheric plasma are examined, the interaction between a neutral wave and the plasma is quantified, and the conditions for growth of resonant plasma waves are established. These conditions are met during the post-sunset period near the geomagnetic equator which is exactly when and where the irregularities are encountered. For irregularity generation, the Rayleigh-Taylor mechanism requires a steep positive gradient of density, a fact that previously has seemed to be impossible on the topside of the F-layer. It is shown that acoustic gravity waves can generate positive slopes even on the topside F-layer. Consequently, acoustic gravity waves constitute a single mechanism that can be used to explain both bottomside and topside irregularities. Dissert. Abstr.

N81-22631 Utah State Univ., Logan.
OH ROTATIONAL TEMPERATURES USING OPTIMAL INTERFEROMETRIC TECHNIQUES Ph.D. Thesis
Gene Anders Ware 1980 270 p
Avail: Univ. Microfilms Order No. 8104285

Advances in infrared interferometer-spectrometer instrumentation made it possible to remotely sense atmospheric hydroxyl airglow spectra at high temporal and spectral resolution. The complex OH spectrum is analyzed to obtain multiple measures of the emission intensities and rotational temperatures. Since the primary night time OH airslow layer is centered at 87 km, the spectral emissions, as observed from the ground, are corrupted by the atmosphere and by instrumental characteristics and noise. These corrupting influences are analyzed in an effort to determine methods for obtaining optimum measures of the spectral intensities and the rotational temperatures. The techniques developed are applied to data taken in the auroral zone under quiet and active conditions, and to midlatitude night airglow and twilight transitions. The internal temperature consistency between hydroxyl band sequences and within individual band structures are analyzed. Dissert. Abstr.

N81-22632*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBJECTIVE ANALYSIS OF OBSERVATIONAL DATA FROM THE FGGE OBSERVING SYSTEMS
W. Baker, D. Edelmann (Sigma Data Services Corp.), M. Iredell (Sigma Data Services Corp.), D. Han (Sigma Data Services Corp.), and S. Jakkempudi (Sigma Data Services Corp.) Mar. 1981 141 p refs
(Contract NAS5-25900)
(NASA-TM-82062) Avail: NTIS HC A07/MF A01 CSCL 04A

An objective analysis procedure for updating the GLAS second and fourth order general atmospheric circulation models using observational data from the first GARP global experiment is described. The objective analysis procedure is based on a successive corrections method and the model is updated in a data assimilation cycle. Preparation of the observational data for analysis and the objective analysis scheme are described. The organization of the program and description of the required data sets are presented. The program logic and detailed descriptions of each subroutine are given. J.D.H.

N81-22633*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
THE GLOBAL DISTRIBUTION OF STRATOSPHERIC OZONE FROM OGO-4 BUV OBSERVATIONS
Mark H. Clayson, Julius London, and Gail P. Anderson (National Center for Atmospheric Research) [1981] 7 p refs
(Grant NsG-5153)
(NASA-CR-164210) Avail: NTIS HC A02/MF A01 CSCL 04A

Latitude-height cross sections of the mass mixing ration are shown for two different years for equinoctial and Northern Hemisphere winter periods. The data represent two week averages for October 1967 and 1968, and for January 1958 and 1969. For October 1967, the ozone distribution is symmetrical about

the equator although the values are higher in the Southern Hemisphere (spring) and about 30-35 km. In October 1968, the distribution about the equator is quite symmetrical. The latitudinal variation at levels above about 3 mb (40 km) is small where photochemical processes are dominant in determining the ozone distribution. In 1967, there is a slight increase at these levels towards the poles that reflect a temperature influence in the ozone chemistry in the upper stratosphere. This increase, however, is absent in 1968. S.F.

N81-22634*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.

THE QUASI-BIENNIAL OSCILLATION IN ATMOSPHERIC OZONE

Samuel J. Oltmans (NOAA, Boulder, Colo.) and Julius London [1981] 90 p refs
(Grant NsG-5153)
(NASA-CR-164209) Avail: NTIS HC A05/MF A01 CSCL 04A

Examination of the relationship between tropical stratosphere zonal wind and ozone indicate a variable response in latitude with Northern Hemisphere tropics and polar regions and Southern Hemisphere mid-latitudes showing the strongest response with relatively weaker response at Northern Hemisphere mid-latitudes and the Southern Hemisphere tropics. In tropical regions, the west winds and ozone maxima are in phase while at higher latitudes, a more nearly out-of-phase relationship prevails. At subtropical and middle latitudes, the QBO in ozone does not appear to change phases with altitude. These features are suggestive of an interaction between the tropical zonal winds and poleward transport of horizontal eddies in conjunction with the annual poleward transport of ozone. Author

N81-22635*# Polytechnic Inst. of New York.

INVESTIGATION OF TRAVELING IONOSPHERIC DISTURBANCES USING THE DIFFERENTIAL DOPPLER DATA FROM THE APOLLO-SOYUZ MISSION Final Report, 1 Mar. 1980 - 28 Feb. 1981

Stanley H. Gross Apr. 1981 30 p refs
(Grant NAGw-51)
(NASA-CR-164203) Avail: NTIS HC A03/MF A01 CSCL 04A

The ASTP Doppler data were recalibrated, analyzed and related to geophysical phenomena and found consistent. Spectra were computed for data intervals covering each hemisphere. As many as 14 such intervals were analyzed. Wave structure is seen in much of the data. The spectra for all those intervals are very similar in a number of respects. They all decrease with frequency, or with decreasing wavelength. Power law fits are reasonable and spectral indices are found to range from about -2.0 to about -3.5. Both large scale (thousands of kilometers) and medium scale (hundreds of kilometers) waves are evident. These spectra are very similar to spectra of in situ measurements of neutrals and ionization measured by Atmosphere Explorer C. T.M.

N81-22636*# Polytechnic Inst. of New York.

INVESTIGATION OF TRAVELING IONOSPHERIC DISTURBANCES Final Report, 1 Mar. 1980 - 28 Feb. 1981

Mario Grossi and R. D. Estes Mar. 1981 22 p refs Prepared for Smithsonian Astrophysical Observatory
(Grant NAGw-51)
(NASA-CR-164211) Avail: NTIS HC A02/MF A01 CSCL 04A

Maximum entropy power spectra of the ionospheric electron density were constructed to enable PINY to compare them with the power independently obtained by PINY with in situ measurements of ionospheric electron density and neutral species performed with instrumentation carried by the Atmospheric Explorer (AE) satellite. This comparison corroborated evidence on the geophysical reality of the alleged electron density irregularities detected by the ASTP dual frequency Doppler link. Roughly half of the localized wave structures which are confined to dimensions of 1800 km or less (as seen by an orbiting Doppler baseline) were found to be associated with the larger crest of the geomagnetic anomaly in the Southern (winter) Hemisphere in the morning. The observed nighttime structures are also associated with local peaks in the electron density. T.M.

N81-22637*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.

THE GEOGRAPHIC BIAS IN DETERMINING AVERAGE VARIATIONS OF TOTAL OZONE FROM GROUND-BASED OBSERVATIONS

Julius London and Xiude Ling [1981] 3 p refs
(Grant NsG-5153)
(NASA-CR-164212) Avail: NTIS HC A02/MF A01 CSCL 04A

The mean monthly hemispheric total ozone values as determined from between the two sets of data indicates that the mean difference between the calculated total ozone amount as determined for the entire period from all the satellite data and that derived from the satellite data restricted to location of ground based stations is 1.3 m atm cm for the Northern Hemisphere and 0.7 m atm cm for the Southern Hemisphere (0.3 and 0.2 percent respectively of the average total ozone in each hemisphere). T.M.

N81-22638*# Texas Univ. at Dallas, Richardson.

CONTINUATION OF DATA ANALYSIS FROM THE ION MASS SPECTROMETER ON THE ISIS-2 SPACECRAFT Semiannual Status Report, Sep. 1980 - Feb. 1981

John H. Hoffman May 1981 6 p
(Grant NsG-5087)
(NASA-CR-164204) Avail: NTIS HC A02/MF A01 CSCL 04A

The spectrometer measures the composition and number density of the positive ion species in the ionosphere as well as the ion flux normal to the spacecraft trajectory. The measurement of high latitude ionospheric dynamics is reported. Plans for an empirical composition model of the polar ionosphere at 1400 km altitude consisting of maps of the major constituent are also reported. T.M.

N81-22639# BDM Corp., Monterey, Calif.

AEROSOL EXTINCTION OVER THE OCEAN: A FIELD EVALUATION OF THE WELLS-MUNN-KATZ MODEL

Christopher W. Fairall 15 Jan. 1981 83 p refs
(Contract N00014-78-C-0204; NR Proj. 086-432)
(AD-A096599; BDM/M-TR-0001-81) Avail: NTIS HC A05/MF A01 CSCL 04/1

Aerosol and Meteorological data from cruises in the East Pacific (CEWCOM-78) and the North Atlantic (JASIN) were used to evaluate the predictive performance of the Wells-Munn-Katz aerosol model. Under given meteorological conditions (wind speed and relative humidity), the model gave very good predictions of the average aerosol extinction coefficient at 10.6 micron wavelength (the standard deviation was about a factor of three). The model did not perform well when asked to predict specific aerosol extinction values. The model continental coefficient, B = 1.7, was found to be too large. The average open ocean value should be B = 0.24. The continental coefficient was found to be important for predicting IR band extinction from visible band extinction estimates. Further analysis demonstrated that much of the variance of continental aerosol spectral density was due to air-mass history and that much of the variance of sea salt aerosol spectral density was due to changes in the marine layer mixing height. GRA

N81-22640# Naval Research Lab., Washington, D. C.

A COHERENT NONLINEAR THEORY OF AURORAL KILOMETRIC RADIATION. 2: DYNAMIC INTERACTIONS

Crockett L. Grabbe and Peter J. Palmadesso 27 Mar. 1981 25 p refs
(AD-A096895; NRL-MR-4440) Avail: NTIS HC A02/MF A01 CSCL 04/1

We present an extension of the analysis of our previously proposed model for auroral kilometric radiation, in which the full three-wave dynamics is considered. The temporal variation of the electrostatic ion cyclotron density fluctuations and the effect of a finite three-wave coupling coefficient, both effects ignored in our steady state theory, are included here. This yields a set of coupled three-wave kinetic equations, which are solved numerically for the evolution of the auroral kilometric radiation. The numerical results tend to confirm all of the predictions of our steady state theory. The growth rate is found to be determined by the resonant growth rate found in our steady state theory,

and stages of the growth are found in which the radiation grows at twice the resonant growth rate, and sometimes four, eight, etc., times that value. The growth saturates, and this saturation level is found to scale where the rate of transfer of energy from the beam to the beat wave, or quasimode. Saturation levels are found which are adequate to produce the observed radiation levels. It is found that for a sufficiently large growth region, the saturation level is relatively independent of the initial level of density fluctuations. GRA

N81-22641# BDM Corp., Monterey, Calif.
ENVIRONMENTAL MEASUREMENTS FOR MAGAT, BLM, AND STREX. INSTRUMENTATION AND DATA ACQUISITION PROGRAMS
C. W. Fairall and D. E. Spiel 12 Feb. 1981 52 p
(Contracts N00014-78-C-0204; N00014-79-C-0088)
(AD-A096942; BDM/M-TR-0003-81) Avail: NTIS HC A04/MF A01 CSCL 04/1

Instrumentation and calibration of certain systems used on aircraft and ships for atmospheric research at NPS are described. Computer programs for acquisition and analysis of aerosol and micrometeorological data are included. GRA

N81-22642# Hawaii Inst. of Geophysics, Honolulu.
SPECTRAL ANALYSES OF HIGH-FREQUENCY Pa Sn PHASES FROM VERY SHALLOW FOCUS EARTHQUAKES Interim Technical Report, 1 Dec. 1978 - 30 Nov. 1980
Daniel A. Walker, George H. Sutton, and C. S. McCreery Nov. 1980 26 p refs
(Contract F49620-79-C-0007; ARPA Order 3291; AF Proj. 3291)
(AD-A096974; AFOSR-81-0277TR) Avail: NTIS HC A03/MF A01 CSCL 17/10

Hydrophone recordings from July 1979 through November 1980 have been examined for mantle-refracted P phases from underground nuclear explosions and from earthquakes at comparable distances. Explosion generated P phases are found to have a lack of energy relative to earthquake generated P phases for frequencies below about 1.3 Hz. Corner frequencies for explosion P's appear to be around 2 Hz while for earthquake P's these frequencies are lower than 1 Hz. Average amplitudes for explosion P's are higher than for earthquake P's for all recorded frequencies above 2 Hz, in spite of the fact that the average explosion magnitude is less than average earthquake magnitude. In the 2.5 to 2.9 Hz range explosion P's are at least 6 db higher than earthquake P's. GRA

N81-22643# Air Force Armament Lab., Eglin AFB, Fla.
DESIGN AND ANALYSIS OF A SEISMICALLY STABLE PLATFORM: AN EVALUATION Final Report
Martin G. Jaenke Aug. 1980 55 p refs
(AF Proj. 9950)
(AD-A096530; AD-TR-80-74) Avail: NTIS HC A04/MF A01 CSCL 17/10

A design of a high precision test platform suitable for the testing of inertial guidance components and systems is evaluated. The platform will also serve as a prototype facility for test concept verification for a planned precision guidance test facility. It is concluded that the proposed passive system is a basically sound concept, although an active system should improve transmissibility of motion. The induction of platform rocking modes by purely translational ground motion is considered. The effect of mismatched seismometer pairs on production of apparent platform rocking modes and the difficulty of matching seismometers to monitor small rotations is discussed. Recommendations are given for analyzing platform performance and interpreting future testing results. J.D.H.

N81-22644# Naval Research Lab., Washington, D. C.
SATELLITE AND ROCKET OBSERVATIONS OF EQUATORIAL SPREAD-F IRREGULARITIES: A TWO-DIMENSIONAL MODEL
E. P. Szuszczewicz, J. C. Holmes, and M. Singh 17 Mar. 1981 30 p refs
(AD-A096562; NRL-MR-4447) Avail: NTIS HC A03/MF A01 CSCL 04/1

Recent rocket and satellite measurements of equatorial F-region irregularities have been able to resolve wavelengths comparable to the meter-size sensitivities of the Jicamarca and Altair radar backscatter techniques. In a July 1979 rocket campaign at the Kwajalein Atoll, vertical profile measurements by in-situ plasma probes showed the F-region marked by a number of large scale plasma depletions, each having its own distribution of smaller scale irregularities and a trend toward a co-location of the more intense irregularities with positive gradients of larger scale features. Similar measurements on the S3-4 Ionospheric Irregularities Satellite have shown large scale depletions (1-3 orders of magnitude) with east-west asymmetries that point toward the western wall as the site for the more intense plasma density fluctuations. The combined rocket and satellite measurements provide a two-dimensional model of macroscopic F-region depletions with small structures tending to develop more readily on the top and western boundaries. The model and associated power spectral analyses is in concert with a developing catalog of radar observations and the predictions of numerical simulations which employ the Rayleigh-Taylor instability as the primary mechanism for the generation of intermediate wavelength irregularities. GRA

N81-22645# Air Force Global Weather Central, Offutt AFB, Nebraska.
SHORT TERM HF FORECASTING AND ANALYSIS
James A. Manley Jan. 1981 112 p refs
(AD-A096833; AD-E850033; AFGWC/TN-81/001) Avail: NTIS HC A06/MF A01 CSCL 04/1

The space forecasting branch of the Air Force Global Weather Central (AFGWC) issues short term HF forecasts and analyses to a wide variety of users. For the forecaster this technical note will illustrate some of the techniques for interpretating the data used in preparing the forecast. For the user of the HF forecast bulletin this technical note will show the limitations of such a forecast. GRA

N81-22646# Argonne National Lab., Ill. Dept. of Astronomy.
SEARCH OF ARCHIVED DATA SOURCES FOR ROCKET EXHAUST-INDUCED MODIFICATIONS OF THE IONOSPHERE
C. C. Chacko and M. Mendillo Sep. 1980 50 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-122) Avail: NTIS HC A03/MF A01

A comprehensive environmental impact study was initiated that involved an unprecedented scope of concerns ranging from ground-level noise and weather modifications to possible planetary-scale perturbations caused by SPS activity in distant Earth orbits. Results of a study of an intermediate region of the Earth's environment (the ionosphere) where large-scale perturbations are caused by routine rocket activity are described. The SPS program calls for vast transportation demands into and out from the ionosphere, and thus the well-known effect of chemical depletions of the ionosphere (so-called ionospheric holes) caused by rocket exhaust signaled a concern over the possible large-scale and long-term consequences of the induced effects. DOE

N81-22647# Los Alamos Scientific Lab., N. Mex.
GEOLOGIC MAP OF THE SULPHUR SPRINGS AREA, VALLES CALDERA GEOTHERMAL SYSTEM, NEW MEXICO
Fraser E. Goff and Jamie N. Gardner Dec. 1980 36 p refs Sponsored by DOE
(LA-8634-MAP) Avail: NTIS HC A03/MF A01

The geologic and tectonic setting and geology of Sulphur Springs Area are described. Geologic faults, sheared or brecciated rock, volcanic vents, geothermal wells, hydrothermal alteration, springs, thermal springs, fumaroles, and geologic deposits are indicated on the map. DOE

N81-22648# Los Alamos Scientific Lab., N. Mex.
GEOLOGIC FRAMEWORK AND HOT DRY ROCK GEOTHERMAL POTENTIAL OF THE CASTLE DOME AREA, YUMA COUNTY, ARIZONA
J. T. Gutmann (Wesleyan Univ.) Feb. 1981 24 p refs
(Contract W-7405-eng-36)
(LA-8723-HDR) Avail: NTIS HC A02/MF A01

The Castle Dome Mountains and surrounding ranges constitute a voluminous pile of silicic volcanic rocks within the

Basin and Range province of southwestern Arizona. Previously reported as Cretaceous and Quaternary in age, these volcancies all are of late Oligocene to early Miocene age as indicated by five new K-Ar dates. Reconnaissance field studies indicate that the volcanic section locally has undergone large rotations that contrast with the usual structural style of the Basin and Range and resemble the thin skinned rotational tectonics documented for earlier, mid Tertiary extensional deformation in ranges to the north and northeast. Significant geothermal potential of the Castle Dome area is suggested by a shallow depth to the Curie isotherm and by the apparent presence of a good electrical conductor at anomalously shallow depth in the crust. Warm wells exist in the area as well as a geothermal gradient of about 700 C/km in a dry well near the center of the gravity low radiogenic heat production in the silicic batholith inferred above constitutes a reasonable candidate for a shallow regional heat source. DOE

N81-22649# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

SOLAR SPECTRAL MEASUREMENTS AND MODELING

Richard E. Bird and Roland L. Hulstrom Jan. 1981 37 p refs

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-642-1013) Avail: NTIS HC A03/MF A01

A newly developed spectroradiometer for routine measurement of the solar spectra is described. This instrument measures the solar spectrum between 300 and 2500 nm in less than 2.5 min, with 0.7 nm resolution in the visible and 10 nm resolution in the infrared. Many examples of global, direct, and diffuse spectra are illustrated for Bedford, Mass. and Golden, Colo. The effects of air mass, turbidity, and Sun tracking on the spectrum are presented, and radiative transfer modeling capabilities and comparisons between models and experiment are discussed. DOE

N81-22650# West Virginia Univ., Morgantown. Dept. of Geology and Geography.

ANALYSIS OF THE STRUCTURAL PARAMETERS THAT INFLUENCE GAS PRODUCTION FROM THE DEVONIAN SHALE. VOLUME 2: DATA REPOSITORY AND REPORTS PUBLISHED DURING FISCAL YEAR 1979 - 1980. REGIONAL STRUCTURE, SURFACE STRUCTURE, SURFACE FRACTURES AND HYDROLOGY Annual Progress Report, 1979 - 1980

J. Negus-DeWys, Jeanette M. Dixon, Mark A. Evans, Kevin D. Lee, James E. Ruotsala, Thomas H. Wilson, and Richard T. Williams Oct. 1980 616 p refs

(Contracts DE-AC21-76ET-12138; DE-AC21-76MC-05194)

(DOE/ET-12138/T1-Vol-2) Avail: NTIS HC A99/MF A01

Appendices giving regional structure data, surface structure data, surface fracture data, and hydrology data are presented. The fracture data cover oriented Devonian shale cores from West Virginia, Ohio, Virginia, Pennsylvania, and Kentucky. The subsurface structure of the eastern Kentucky gas field is also covered. DOE

N81-22651# West Virginia Univ., Morgantown. Dept. of Geology and Geography.

ANALYSIS OF THE STRUCTURAL PARAMETERS THAT INFLUENCE GAS PRODUCTION FROM THE DEVONIAN SHALE. VOLUME 3: DATA REPOSITORY AND REPORTS Annual Progress Report, 1979 - 1980

J. Negus-DeWys Oct. 1980 597 p refs Presented at 26th Intern. Geol. Congr., Paris, Jul. 1980 Submitted for publication

(Contracts DE-AC21-76ET-12138; DE-AC21-76MC-05194)

(DOE/ET-12138/T1-Vol-3) Avail: NTIS HC A25/MF A01

Inorganic geochemistry studies of the Eastern Kentucky Gas Field, lithology studies of upper Devonian well cuttings in the Eastern Kentucky Gas Field, and possible effects of plate tectonics on the Appalachian Devonian black shale production in eastern Kentucky are examined. Preliminary depositional model for upper Devonian Huron age organic black shale in the Eastern Kentucky Gas Field, the anatomy of a large Devonian black shale gas field, the Cottageville (Mount Alto) Gas Field, Jackson County, West Virginia: a case study of Devonian shale gas production, the Eastern Kentucky Gas Field: a geological study of the relationships of Ohio shale gas occurrences to structure, stratigraphy, lithology, and inorganic geochemical parameters, and a statistical analysis of geochemical data for the Eastern Kentucky Gas Field are also included. DOE

N81-22652# Research Inst. of National Defence, Stockholm (Sweden).

INTERNATIONAL SEISMOLOGICAL DATACENTER. AN ALGORITHM FOR ASSOCIATING REPORTED ARRIVALS TO A GLOBAL SEISMIC NETWORK INTO GROUPS DEFINING SEISMIC EVENTS

Ragnar Slunga Nov. 1980 54 p refs

(FOA-C-20386-T1) Avail: NTIS HC A04/MF A01

The term event entry is introduced for any combination of three kinematical observations (arrival times, slownesses or azimuths) and the completeness of the algorithm is assured by the testing of all event entries. However, restrictions in the complete search are needed to avoid unacceptable computer times. These restrictions are based on the principle that the observations defining a new event must all have full evidential value. This means that the defining observations of the new event are not allowed to be predicted by another event. The decision rules used are based on statistical confidence intervals. Author (ESA)

N81-22653# Danish Meteorological Inst., Copenhagen.

OCCURRENCES OF THE POLAR SLANT E CONDITION (SEC)AT NARSSARSSUAQ, GODHAVN, THULE IN 1979 Monthly Data Sheets

I. S. Primdahl 1980 96 p refs

(ISBN-87-7478-175-8) Avail: NTIS HC A03/MF A01

Tables of slant E condition (both certain and doubtful cases) scaled from ionograms from Thule, Godhavn, and Narssarssuaq for 1979 are presented. Data are in monthly data sheets. Author (ESA)

N81-22654# Danish Meteorological Inst., Copenhagen.

THE DEPENDENCE OF AURORAL ACTIVITY ON K SUB P AS DETERMINED BY THE USE OF AN EXTENSIVE DATABASE

Christian Danielsen 1980 52 p refs

(R-60; ISBN-87-7478-178-2) Avail: NTIS HC A04/MF A01

A catalog of discrete auroral forms was compiled from the Greenland all sky camera network during the winter 1973-74. A procedure is evaluated which gives plots of the frequency of occurrence and patterns of mean alignments in corrected geomagnetic latitude (CGL)-time coordinates. By the combined use of alignment patterns and plots of the occurrence frequency it is possible to demonstrate the distribution of the auroral activity as a function of the geomagnetic disturbance over the polar cap out to 64 deg CGL except for some hours in the afternoon. Author (ESA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-22655 Wisconsin Univ. - Madison.

DIAGNOSTIC STUDY OF WARM-CORE ANTICYCLONES ASSOCIATED WITH A BLOCKING CIRCULATION PATTERN Ph.D. Thesis

Allen Joseph Lenzen 1980 233 p

Avail: Univ. Microfilms Order No. 8028190

The integrated treatment of the mass, absolute angular momentum, and kinetic energy budgets of the central portion of a blocking anticyclone is presented. Budgets are evaluated for the period from 12 GM 17 April 1971 through 12 GMT 1 May 1971 during which a blocking pattern of circulation persisted over Canada Quasi-Lagrangian diagnostics using isentropic coordinates evaluated for a cylindrical budget volume that is centered over the surface position of the anticyclone. The classical picture of inward lateral mass transport in the upper troposphere, sinking motion, and outward lateral mass transport in the lower troposphere is confirmed. The mass-weighted and area-averaged heating rates, calculated as a residual in the mass budget, indicate a cooling rate of up to 1-2K/day throughout

the troposphere. An independent direct evaluation of the heating rate yields a similar value. Dissert. Abstr.

N81-22656 California Univ., San Diego.
AN ANALYSIS OF CLOUD PROPERTY RETRIEVAL USING INFRARED SOUNDER DATA Ph.D. Thesis
Bruce Anthony Wielicki 1980 137 p
Avail: Univ. Microfilms Order No. 8107475

The cloud properties considered are effective cloud amount (emissivity times cloud fractional coverage in the satellite field of view), cloud top pressure, and the ratio of cloud emissivities in different spectral regions of the infrared. The cloud amount errors and cloud top pressure errors caused by instrument noise and by uncertainties in estimated clear sky radiances due to temperature profile and water vapor profile uncertainties were examined. The retrieval errors appropriate for a cloud climatology of average cloud amount within 1 km cloud height intervals were studied. Dissert. Abstr.

N81-22657 Indiana State Univ., Terre Haute.
COLD FRONT CLOUD MORPHOMETRY: A CLIMATOLOGICAL ASSESSMENT USING SATELLITE IMAGERY Ph.D. Thesis
Louis Michael Trapasso 1980 121 p
Avail: Univ. Microfilms Order No. 8108100

Statistical relationships were established between the shape and configuration (morphometry) of the CFCBs and the characteristics of maritime tropical (mT) and continental polar (cP) air masses which meet to form the cold front. An electronic graphics calculator was used to measure CFCBs from hardcopy GOES/SMS visible and infrared images. Air mass data were derived from a number of NWS surface and upper air charts. Cloud band morphometric variables and corresponding air mass data were assembled for seventy CFCB cases as they existed over the continental United States east of 100 deg west longitude from June 1979 through May 1980. Dissert. Abstr.

N81-22658*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARATIVE STATISTICAL STUDY OF LONG-TERM AGROCLIMATIC CONDITIONS AFFECTING THE GROWTH OF US WINTER WHEAT: DISTRIBUTIONS OF REGIONAL MONTHLY AVERAGE PRECIPITATION ON THE GREAT PLAINS AND THE STATE OF MARYLAND AND THE EFFECT OF AGROCLIMATIC CONDITIONS ON YIELD IN THE STATE OF KANSAS
Jean Welker Apr. 1981 189 p refs
(NASA-TP-1724; Rept-80F5125) Avail: NTIS HC A09/MF A01 CSCL 04B

A histogram analysis of average monthly precipitation over 30 and 84 year periods for both Maryland and Kansas was made and the results compared. A second analysis, a statistical assessment of the effect of average monthly precipitation on Kansas winter wheat yield was made. The data sets covered the three periods of 1941-1970, 1887-1970, and 1887-1921. Analyses of the limited data sets used (only the average monthly precipitation and temperature were correlated against yield) indicated that fall precipitation values, especially those of September and October, were more important to winter wheat yield than were spring values, particularly for the period 1941-1970. T.M.

N81-22659*# Computer Sciences Corp., Huntsville, Ala.
VECTOR WIND PROFILE GUST MODEL Final Report, 10 Apr. 1980 - 9 Apr. 1981
Stanley I. Adelfang 1981 35 p refs
(Contract NAS8-33433)
(NASA-CR-161689) Avail: NTIS HC A03/MF A01 CSCL 04B

To enable development of a vector wind gust model suitable for orbital flight test operations and trade studies, hypotheses concerning the distributions of gust component variables were verified. Methods for verification of hypotheses that observed gust variables, including gust component magnitude, gust length, u range, and L range, are gamma distributed and presented. Observed gust modulus has been drawn from a bivariate gamma distribution that can be approximated with a Weibull distribution. Zonal and meridional gust components are bivariate gamma distributed. An analytical method for testing for bivariate gamma distributed variables is presented. Two distributions for gust modulus are described and the results of extensive hypothesis testing of one of the distributions are presented. The validity of the gamma distribution for representation of gust component variables is established. J.D.H.

N81-22660*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF THE EXTENDED-RANGE FORECASTING PROBLEM BLOCKING Final Report
Tsing-Chang Chen (Iowa State Univ.), Hal G. Marshall (Iowa State Univ.), and J. Shukla Mar. 1981 208 p refs
(Grant NsG-5339)
(NASA-TM-82343) Avail: NTIS HC A10/MF A01 CSCL 04B

Wavenumber frequency spectral analysis of a 90 day winter (Jan. 15 - April 14) wind field simulated by a climate experiment of the GLAS atmospheric circulation model is made using the space time Fourier analysis which is modified with Tukey's numerical spectral analysis. Computations are also made to examine how the model wave disturbances in the wavenumber frequency domain are maintained by nonlinear interactions. Results are compared with observation. It is found that equatorial easterlies do not show up in this climate experiment at 200 mb. The zonal kinetic energy and momentum transport of stationary waves are too small in the model's Northern Hemisphere. The wavenumber and frequency spectra of the model are generally in good agreement with observation. However, some distinct features of the model's spectra are revealed. The wavenumber spectra of kinetic energy show that the eastward moving waves of low wavenumbers have stronger zonal motion while the eastward moving waves of intermediate wavenumbers have larger meridional motion compared with observation. Furthermore, the eastward moving waves show a band of large spectral value in the medium frequency regime. A.R.H.

N81-22661# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Data Base Development Section.
BIVARIATE NORMAL WIND STATISTICS MODEL: USER'S MANUAL
Benjamin Novograd Sep. 1980 30 p
(AD-A096796; AD-E850021; USAFETAC/TN-80-003) Avail: NTIS HC A03/MF A01 CSCL 04/2

User instructions, sample input, sample output, and processing times are provided for USAFETAC/DND's wind statistics model. This model's basic input consists of five wind statistics: the means and standard deviations of the zonal and meridional wind components, and the correlation coefficient of these components. The model uses a bivariate normal distribution of these wind components to generate its output. The model's users can interactively select one or several of its output options. Each option generates a different type of output. The available options include: points on an elliptical probability contour, the probability of a range of wind directions, the probability of a range of wind speeds, the joint probability of a range of wind speeds and directions, new basic wind statistics using a rotated coordinate system, and the conditional probability of a range of wind speeds given a wind direction. GRA

N81-22662# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
CIRRUS PARTICLE DISTRIBUTION STUDY. PART 6: AIR FORCE SURVEYS IN GEOPHYSICS
Ian D. Cohen and Arnold A. Barnes, Jr. 4 Sep. 1980 105 p refs
(AF Proj. 317j)
(AD-A096772; AFGL-TR-80-0261-Pt-6; AFGL-AFSG-430-Pt-6) Avail: NTIS HC 06/MF A01 CSCL 04/1

Cirriform clouds associated with a frontal system which passed through New Mexico on 4 and 5 April 1978 were sampled by a MC-130E which has been equipped with cloud physics instrumentation by AFGL. The clouds sampled were thin cirrus and cirrostratus layers in advance of the front on 4 April and behind the same front on 5 April. Particle sizes were small; maximum sizes on 4 April were approximately 700 microns. On 5 April, few clouds could be found, but one patch yielded particles as large as 1300 micron. Particle distribution curves are presented

for three 5-min periods from the 4 April flight and one 5-min period from the 5 April flight. Additionally, consecutive 30-sec average distributions are presented for selected time periods from each of the flights. In addition to the visible cirrus clouds, particles were also found in clear air between the cirrus clouds. Some of the sub-visible cirrus particles seemed to come from clouds above the aircraft, but other instances of sub-visible cirrus occurred when there were no visible cirrus above the aircraft suggesting that the particles had developed in-situ. GRA

N81-22663# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology and Physical Oceanography.
THE FEASIBILITY OF A LOW-ORDER MODEL OF A MOIST GENERAL CIRCULATION Final Report, 1 Nov. 1977 - 30 Oct. 1980
Edward N. Lorenz Hanscom AFB, Mass. AFGL 30 Nov. 1980 40 p refs
(Contract F19628-78-C-0032; AF Proj. 2310)
(AD-A096704; AFGL-TR-80-0354) Avail: NTIS HC A03/MF A01 CSCL 04/1

A low-order two-level quasi-geostrophic model of a moist general circulation is formulated. The model consists of a system of 27 ordinary differential equations, or, in one variant, 20 equations. Modeled processes include evaporation from the ocean, condensation and evaporation within the atmosphere, precipitation reflection of solar radiation by clouds, and absorption and emission of long-wave radiation by clouds and water vapor. A portion of the region represented by a single grid point may be subsaturated while another portion contains clouds. A wide variety of numerical experiments may be performed with the model. When the prescribed solar heating is horizontally uniform, there are sometimes two distinct states of stable equalibrium - a very cold state and a very warm state. GRA

N81-22664# United Industries Corp., Bellevue, Wash.
WIND FIELD PREDICTIONS FOR THE COLUMBIA GORGE AND THE GOODNOE HILLS WIND TURBINE SITE
Scott D. Veenhuizen and Jung-Tai Lin Aug. 1980 104 p refs
(Contract DE-AC79-80BP-18979)
(DOE/BP-18979/T1; UIC-8003) Avail: NTIS HC A06/MF A01

Numerical estimates of the long term seasonal mean wind speeds, wind directions, and available wind power density were conducted for comparison with the results of field wind measurements obtained for the Columbia Gorge region along the Oregon Washington border. The numerical technique was used as a generalized wind prospecting tool to provide the link between regional assessments and on site biological or geomorphological indicators of mean wind speeds and available wind energy. The wind flow model used is a two dimensional model based upon simplified hydrodynamical equations describing the fluid and thermodynamic motion of the atmosphere. DOE

N81-22665# Battelle Pacific Northwest Labs., Richland, Wash.
METEOROLOGICAL ASPECTS OF SITING LARGE WIND TURBINES
T. R. Hiester and W. T. Pennell Jan. 1981 512 p refs
(Contract DE-AC06-76RL-01830)
(PNL-2522) Avail: NTIS HC A22/MF A01

The elements of a siting strategy that will identify the most favorable wind energy sites in a region and that will provide sufficient wind data to make responsible economic evaluations of the site wind resource possible are outlined. Siting techniques that were studied in the Department of Energy (DOE) Wind Energy Program are summarized. A major goal is to educate utility technical personnel, engineering consultants, and meteorological consultants (who may have not yet undertaken wind energy consulting) on meteorological phenomena relevant to wind turbine siting in order to enhance dialogues between these groups. DOE

N81-22666# Deutscher Wetterdienst, Offenbach am Main (West Germany).
INVESTIGATIVE TECHNICAL MEASUREMENTS OF THE PLANETARY BOUNDARY LAYER MADE ONBOARD AN INSTRUMENTED MOTORIZED GLIDER [MESSTECHNISCHE UNTERSUCHUNG DER PLANETARISCHEN GRENZCHICHT MIT HILFE EINES INSTRUMENTIERTEN MOTORSEGLERS]
Heinz Fortak (Freie Univ., West Germany) 1980 167 p In GERMAN; ENGLISH summary Sponsored by Deutsche Forschungsgemeinschaft (DFG)
(Rept-149; ISBN-3-88149-174-5; ISSN-0072-4130) Avail: NTIS HC A08/MF A01

Research into the planetary boundary layer is described. An instrumented motorized glider was used in making observations. The most important task of the experiment was the investigation of convective processes and their interactions with neighboring scales. Results show the strong variability of the vertical structure of the atmosphere caused by convection, the life cycle of individual convective cells, the two dimensional distribution of those cells, and their dependence on surface properties as well as the interactions between convection and lee waves, including cloud streets. Author (ESA)

N81-22667# Flowpower, Inc., Huntington Station, N.Y.
HIGH YIELD WIND ENERGY RESOURCES IN NEW YORK STATE Final Report, May 1979 - May 1980
P. M. Sforza, M. J. Smorto, and B. Bailey Jun. 1980 177 p refs
(PB81-142754; NYSERDA-80-11) Avail: NTIS HC A09/MF A01 CSCL 04A

A wind energy inventory for New York state is based on data collected at numerous meteorological stations and anemometers, throughout the state. There are a number of regions in the state which could possibly host one or more large (greater than 100kW) wind turbine generators. An extensive analysis of life cycle electrical energy production costs is given for various wind turbine generators which are now being manufactured or which will be manufactured in the near future. GRA

N81-22668# National Weather Service, Salt Lake City, Utah. Western Region.
TROPICAL CYCLONE EFFECTS ON CALIFORNIA
Arnold Court Oct. 1980 159 p refs Prepared in cooperation with California State Univ., Northridge
(PB81-133779; NOAA-TM-NWS-WR-159; NOAA-80120904) Avail: NTIS HC A03/MF A01 CSCL 04B

The growing awareness of the consequences to southwestern United States, especially California, of storms from the south is traced with accounts of more than thirty tropical cyclones that affected southern California from 1906 to 1978. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-22669 California Univ., San Diego.
STABILITY OF LONG RANGE ACOUSTIC MULTIPATHS Ph.D. Thesis
John Louis Spiesberger 1980 46 p
Avail: Univ. Microfilms Order No. 8107473

The behavior of acoustic multipaths in long range transmissions through weak and strong mesoscale ocean environments is investigated in two experiments. In the first experiment, a phase coded signal with 64 ms resolution is transmitted at 10 min intervals for 48 days between an acoustic source moored at 2000 m depth and a bottom mounted receiver at approximately 3000 m depth and at approximately 900 km range. About 16 multipaths are resolved. They are stable in the presence of relatively weak ocean fluctuations and can be identified (with some exceptions) from ray theory. In the second experiment the same signal is transmitted for 19 days over two 300 km range paths to the north and south. The acoustic source is moored at 2000 m depth northwest of Bermuda. One receiver is moored at 2000 m depth to the north of the source and the other receiver is bottom mounted at 1000 m depth south of the source near Bermuda. The multipaths recorded from the southern path are stable. Dissert. Abstr.

N81-22670 Texas A&M Univ., Galveston.
FREQUENCY-WAVENUMBER SPECTRA OF SEA SURFACE TEMPERATURE AND WIND STRESS IN THE EASTERN

NORTH PACIFIC AND THEIR RELATION TO LOCALLY FORCED LOW FREQUENCY FLUCTUATIONS IN THE OCEAN Ph.D. Thesis
Garcia Artemio Gallegos 1980 161 p
Avail: Univ. Microfilms Order No. 8108011

Frequency-wavenumber spectra of sea surface temperature, wind stress components, and wind stress curl data from ship observations taken in the eastern North Pacific are presented. The reliability of the method of analysis is discussed in order to determine the validity of the conclusions derived from the computed spectra. The estimated spectra of wind stress curl and sea surface temperature (buoyancy flux) are applied in a linear model for quasi-geostrophic response to surface forcing. The results of this model, using a reasonable value for the coefficient of thermal diffusion, indicate that the curl of the wind stress is the major forcing function for the subinertial oceanic variability. However, the annual Fourier component of the sea surface temperature fluctuations is strong enough to induce baroclinic Rossby waves like those observed in the eastern North Pacific. Frequency spectra of potential energy derived from the model's total response are compared to a frequency spectrum of potential energy obtained from observations of subsurface isotherm fluctuations for this same area of the ocean.
Dissert. Abstr.

N81-22671 Oregon State Univ., Corvallis.
MEAN AND TIME-DEPENDENT TEMPERATURE AND VORTICITY BALANCES IN THE SUB-TROPICAL NORTH ATLANTIC Ph.D. Thesis
Thomas Keffer 1981 206 p
Avail: Univ. Microfilms Order No. 8108205

The North Atlantic mesoscale eddy field, as observed by POLYMODE Array 3, is discussed and compared with previous MODE and POLYMODE studies. Cluster A, located on the western slopes of the Mid-Atlantic Ridge, had similar characteristics with the MODE region with longer time scales and reduced deep water energies due to the rough topography. Cluster B, on the eastern slopes, showed bottom trapping of energy, perhaps due to western intensification within the eastern basin. Cluster C, in the Atlantic North Equatorial Current, showed a complex vertical structure and little or no down gradient heat fluxes. The Array 3 current meter data was used to derive absolute u, v, w mean velocity profiles at the three clusters. These were then used to determine the mean potential temperature, salinity, and potential density balances. These were found to be consistent with horizontal eddy diffusion and vertical salt fingering.
Dissert. Abstr.

N81-22672# Washington Univ., Seattle. Polar Science Center.
SEA ICE DISPLACEMENT FROM SEASAT SYNTHETIC APERTURE RADAR
R. T. Hall and D. A. Rothrock 1981 17 p refs Submitted for publication
(N00014-79-C-0418)
(AD-A096485) Avail: NTIS HC A02/MF A01 CSCL 17/9

Images obtained by a synthetic aperture radar on Seasat have been used to measure sea ice displacements over a three day interval in October 1978. The data points lie roughly along a line and are quite dense, about 2 km apart, over a distance of 863 km. The displacements are about twenty kilometers. Displacement errors grow with distance from shore becoming as large as 3 km. The graph of displacement versus distance has occasional discontinuities of several kilometers. Displacement discontinuities are accurate to + or - 0.07 km along track and 3% of their magnitude across track. GRA

N81-22673# Washington Univ., Seattle. Applied Physics Lab.
A COMPARISON OF VELOCITY PROFILES OBTAINED FROM AN EXPENDABLE TEMPERATURE AND VELOCITY PROFILE (XTVP) AND AN ACOUSTICALLY TRACKED PROFILER AT THE ATLANTIC UNDERWATER TEST AND EVALUATION CENTER (AUTEC)
Thomas B. Sanford, John H. Dunlap, and Robert G. Drever Feb. 1981 74 p refs Prepared in cooperation with Applied Physics Lab., John Hopkins Univ., Laurel Md.
(Contract N00014-80-C-0347)
(AD-A097051; APL-UW-8105) Avail: NTIS HC A04/MF A01 CSCL 08/1

A series of nearly simultaneous drops of two velocity profilers was made at the Atlantic Underwater Test and Evaluation Center (AUTEC). One profiling method was based on the measurement of motionally induced electric currents by an expendable device. This profiler, the Expendable Temperature and Velocity Profiler (XTVP), was compared with an acoustically tracked free-fall device operated by personnel of the Johns Hopkins University's Applied Physics Laboratory. Based on drops separated by less than 100 m horizontally and about 50 minutes in time, the two sets of profiles were found to agree within about 1 cm/s rms for east and north horizontal velocity components. GRA

N81-22674# Skidaway Inst. of Oceanography, Savannah, Ga.
BIOLOGICAL PROCESSES IN THE WATER COLUMN OF THE SOUTH ATLANTIC BIGHT Progress Report
G. A. Paffenhoefer and J. A. Yoder Feb. 1981 6 p refs
(Contract DE-AS09-76EV-00936)
(DOE/EV-00936/5) Avail: NTIS HC A02/MF A01

The development of a wind induced upwelling and its effect on outer shelf chlorophyll distribution was followed. Phytoplankton productivity measurements obtained during GABEX I and other DOE sponsored cruises were used to estimate primary and new production of the outer shelf during winter and spring. DOE

N81-22675# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
SEA STATE MEASUREMENT WITH A TWO FREQUENCY SCATTEROMETER: THEORY
Michael Kelintz May 1980 161 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-710)
(DFVLR-FB-80-32) Avail: NTIS HC A08/MF A01

In the context of the SPACELAB program, sea state measurements with a two frequency scatterometer are considered. A system analysis of two frequency scatterometry, especially signal analysis for stationary and airborne (aircraft; satellite) measurements, is presented, and an unambiguous method for wind direction determination is given. A statistical model of sea state, based on the frequency spectrum of the water wave height distribution, is used. The radar echo from the sea surface is characterized for a monochromatic output signal. An autocorrelation function is developed, and application in consideration of the Doppler spectrum of the sea surface reflectance function is shown. Author (ESA)

N81-22676# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
PHYSICAL OCEANOGRAPHIC CONDITIONS IN THE TROPICAL SOUTH ATLANTIC RELATIVE TO THE PLACEMENT OF A GRAZING OTEC (OCEAN THERMAL ENERGY CONVERSION) PLANT
Robert L. Molinari May 1980 92 p refs
(PB81-142606; NOAA-TM-ERL-AOML-43; NOAA-80110410) Avail: NTIS HC A05/MF A01 CSCL 08J

A synthesis of historical and recently collected data provides a characterization of the physical oceanographic and meteorological conditions in a portion of the tropical South Atlantic. The area, bounded by 5 degrees S and 15 degrees S and 20 degrees W and 30 degrees W, was selected as a possible site for a grazing Ocean Thermal Energy Conversion plant. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-22677# Public Service Electric and Gas Co., Newark, N. J.
BIOFOULING CONTROL WITH OZONE AT THE BERGEN GENERATING STATION Interim Report
R. Sugam, C. R. Guerra, J. L. DelMonaco, J. H. Singletary, and W. A. Sandvik Nov. 1980 143 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 733-1)
(EPRI-CS-1629) Avail: NTIS HC A07/MF A01

Tests were conducted using a pilot scale condenser system to simulate plant condenser operations. Three model condensers were operated under identical conditions with only the biocide treatment differing. Comparisons of ozone and chlorine were made and the minimum effective levels of each were determined by daily measurements of the heat transfer coefficient across the model condenser tubes and/or the water side pressure drop. Test results indicate that chlorine is capable of effective biofouling control when applied for 2 hours/day at a level as low as 0.1 mg/1. Ozone, applied on the same schedule, requires 0.5 mg/1 for effective control. DOE

N81-22678# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Chemistry.
PHYSICO-CHEMICAL INVESTIGATION OF SOME AREAS OF FUNDAMENTAL SIGNIFICANCE TO BIOPHYSICS Annual Report, 1979 - 1980
S. P. McGlynn 7 Jul. 1980 85 p refs
(Contract DE-AS05-76EV-03018)
(DOE/EV-03018/T2) Avail: NTIS HC A05/MF A01

Results of physico-chemical investigations dealing with primarily molecular Rydberg transitions are presented. Spectroscopic studies of atmospheric pollutants, the colors of post-transition metal salts, and photoelectron spectroscopy of phosphites, phosphates, and substituted phosphates are included. A perturbed linear molecular model for the spectroscopy of linear molecules is presented. DOE

N81-22679*# California Univ., Davis. Dept. of Entomology.
ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS): STUDIES OF HONEY BEES EXPOSED TO 2.45 GHz CONTINUOUS WAVE ELECTROMAGNETIC ENERGY
N. E. Gary and B. B. Westerdahl Dec. 1980 147 p refs Sponsored in part by NASA Prepared for Argonne National Lab.
(Contract W-31-109-eng-38)
(NASA-CR-164223; DOE/ER-0095) Avail: NTIS HC A07/MF A01 CSCL 06C

Post treatment brood development was normal and teratological effects were not detected at exposures of 3 to 50 mw sq cm for 30 minutes. Post treatment survival, longevity, orientation, navigation, and memory of adult bees were also normal after exposures of 3 to 50 mw sq cm for 30 minutes. Post treatment longevity of confined bees in the laboratory was normal after exposures of 3 to 50 mw sq cm for 24 hours. Thermoregulation of brood nest, foraging activity, brood rearing, and social interaction were not affected by chronic exposure to 1 mw sq cm during 28 days. In dynamic behavioral bioassays the frequency of entry and duration of activity of unrestrained, foraging adult bees was identical in microwave exposed areas versus control areas. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-22680* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 217, MARCH 1981
Mar. 1981 50 p
(NASA-SP-7011(217)) Avail: NTIS HC $7.00 CSCL 06E

Approximately 130 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1981 are included in this bibliography. Topics include aerospace medicine and biology. S.F.

N81-22681 California Univ., Santa Barbara.
TOTAL AND REGIONAL DISTRIBUTION OF CORONARY BLOOD FLOW DURING HYPOXIA Ph.D. Thesis
Richard Anthony Sorich 1980 247 p
Avail: Univ. Microfilms Order No. 8108075

The adjustments made by the coronary and cardiovascular systems were studied during carbon monoxide hypoxia (COH) due to 29-35 percent HbCO and hypoxia hypoxia (HOH) due to inhalation of 95 percent O2, which represent comparable arterial hypoxias when both arterial oxygen content and O2 availability are considered. As a result of COH, coronary blood flow (CBF) increased 40 percent as the arterial oxygen content decreased from 18.7 to 14.7 ml O2 100 ml-1 blood. Coronary sinus Po2 decreased 4.5 torr, which fully compensated for the increased O2 affinity for Hb. Lactate extraction, as well as pH, remained unchanged throughout the COH exposure. No significant change was observed in either cardiac index, heart rate, or mean arterial blood pressure. Dissert. Abstr.

N81-22682* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 218, APRIL 1981
Apr. 1981 62 p
(NASA-SP-7011(218)) Avail: NTIS HC $7.00 CSCL 06E

This bibliography lists 161 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1981. A.R.H.

N81-22683*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF MEPROBAMATE ON THE VESTIBULOSENSORY AND VESTIBULAR SOMATIC REACTION
N. V. Khinchikashvili Mar. 1980 13 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 25, no. 5, 1979 p 507-512 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Odessa Medical Inst., USSR
(Contract NASw-3198)
(NASA-TM-76104) Avail: NTIS HC A02/MF A01 CSCL 06P

The influence of meprobamate on the vestibular illusion of counter-rotation, movement coordination and vertical writing was investigated by a double blind trial method and placebo. The results confirm the possibility of the meprobamate application for prophylaxis and correction of vestibular disturbances. Author

N81-22684*# National Aeronautics and Space Administration, Washington, D. C.
PHYSIOLOGY OF MAN AND ANIMALS IN THE TENTH FIVE-YEAR PLAN: PROCEEDINGS OF THE THIRTEENTH CONGRESS OF THE I. P. PAVLOV ALL-UNION PHYSIOLOGICAL SOCIETY
K. A. Lange Aug. 1980 26 p Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 66, no. 5, May 1980 p 757-771 Congr. held in Alma-Ata, USSR, 24-28 Sep. 1979 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR), Leningrad
(Contract NASw-3198)
(NASA-TM-76296) Avail: NTIS HC A03/MF A01 CSCL 06P

Research in the field of animal and human physiology is reviewed. The following topics on problems of physiological science and related fields of knowledge are discussed: neurophysiology and higher nervous activity, physiology of sensory systems, physiology of visceral systems, evolutionary and ecological physiology, physiological cybernetics, computer application in physiology, information support of physiological research, history and theory of development of physiology. Also discussed were: artificial intelligence, physiological problems of reflex therapy, correlation of structure and function of the brain, adaptation and activity, microcirculation, and physiological studies in nerve and mental diseases. E.A.K.

N81-22685*# National Aeronautics and Space Administration, Washington, D. C.
QUESTIONS OF DIAGNOSING AND TREATING MENIERE'S DISEASE
S. N. Khechinashvili Oct. 1980 12 p refs Transl. into ENGLISH from Zh. Ushnykh Nosovykh Gorlovykh Bolez. (USSR), no. 5, 1979 p 1-5 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by S. M. Kirov State Inst. for Advancement of Physicians, Tbilisi, USSR
(Contract NASw-3198)

(NASA-TM-76407) Avail: NTIS HC A02/MF A01 CSCL 06E

The possibilities of diagnosis and treatment of Meniere's disease are considered. Attention is given to the use of dehydration tests which are based on glycerol administration or intravenous injection of furosemide. The risks of bilateral sensorineural hearing impairment in prolonged conservative treatment is emphasized. The data of auditory function study before and following endolymphatic sac surgery are presented. Author

N81-22686*# National Aeronautics and Space Administration, Washington, D. C.

VISUAL EVALUATION OF NYSTAGMUS INTENSITY IN POINTS TO DIAGNOSE VESTIBULAR DYSFUNCTION

M. M. Levashov Oct. 1980 11 p refs Transl. into ENGLISH of Zh. Ushnykh Nosovykh Gorlovykh Bolez. (USSR), no. 5, Sep. - Oct. 1979 p 29-33 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by RSFSR Ministry of Health, Leningrad

(Contract NASw-3198)

(NASA-TM-76409) Avail: NTIS HC A02/MF A01 CSCL 06P

The amplitude of nystagmus multiplied by its frequency gives a value commensurate to the velocity of slow phase. If the amplitude and the frequency during the visual observation are expressed in relative units (e.g., in points ranging from 1 to 3) the results of multiplication are used for a relative evaluation of nystagmus intensity. The relative evaluation of nystagmus intensity is used to compare the responses and, in particular, to calculate the coefficients of labyrinth asymmetry and of directional preponderance. A suggestion is made to analyze the formal results of caloric tests using a simple graphic model reflecting the left-right interactions by which the obtained coefficients are conditioned. S.F.

N81-22687*# National Aeronautics and Space Administration, Washington, D. C.

FUNCTIONAL STABILITY OF CEREBRAL CIRCULATORY SYSTEM

Yu. Ye. Moskalenko Oct. 1980 18 p refs Transl. into ENGLISH from Fiziol. SSSR (USSR), v. 64, no. 5, 1978 p 589-597 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76499) Copyright. Avail: NTIS HC A02/MF A01 CSCL 06P

The functional stability of the cerebral circulation system seems to be based on the active mechanisms and on those stemming from specific of the biophysical structure of the system under study. This latter parameter has some relevant criteria for its quantitative estimation. The data obtained suggest that the essential part of the mechanism for active responses of cerebral vessels which maintains the functional stability of this portion of the vascular system, consists of a neurogenic component involving central nervous structures localized, for instance, in the medulla oblongata. Author

N81-22688*# National Aeronautics and Space Administration, Washington, D. C.

RADIOLOGICAL EXAMINATION OF THE SPINE AND FITNESS FOR WORK AS A HELICOPTER PILOT

R. P. Delahaye, R. Auffret, and P. J. Metges Jun. 1980 8 p refs Transl. into ENGLISH of "Examen Radiologique du Rechis et Aptitude a l'Emploi de Pilot d'Helicoptere" Rept. AGARD-CP-255, Paris, Dec. 1978 p 56-1-56-7 Translation was announced as N79-19634 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Aerospace Research and Development, Paris

(Contract NASw-3199)

(NASA-TM-75791; AGARD-CP-225) Avail: NTIS HC A02/MF A01 CSCL 06P

On the matter of spinal fitness for piloting, standards are proposed that suit the critical spinal segments proper to different jobs. Involved here are primarily pilots of combat airplanes and of helicopters. Fitness for one of these does not necessarily mean fitness for the other. Author

N81-22689*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF SHORT-TERM ANTIORTHOSTATIC HYPOKINESIA ON CENTRAL AND INTRACARDIAC HEMODYNAMICS AND METABOLISM OF A HEALTHY PERSON

V. Ye. Katkov, V. V. Chesturkhin, O. Kh. Zybin, S. S. Sukhotskiy, S. V. Abrosimov, and V. N. Utkin Feb. 1981 17 p refs Transl. into ENGLISH from Kardiologiya (USSR), no. 12, 1978 p 69-75 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76525) Avail: NTIS HC A02/MF A01 CSCL 06S

The right parts of the heart and the radial artery were catheterized in healthy male volunteers before and 5 days after strict bedrest in antiorthostatic position of the body (-4.5 deg). After immobilization, most values of central circulation showed no essential changes; the only exceptions were indicates characterizing the inotropic myocardial condition. A shift in the direction of acidosis of a mixed character was noted in mixed venous blood, the beta lipoprotein content increased. A decrease in the arteriovenous difference in oxygen was encountered in blood draining from the heart (from the coronary sinus). Author

N81-22690*# National Aeronautics and Space Administration, Washington, D. C.

EVALUATION OF INTEGRAL EXPOSURE ENERGY LOAD ON AURAL ANALYZER OF MINERS

A. N. Kornilov and Ye. I. Larantseva Feb. 1981 8 p refs Transl. into ENGLISH from Vrach. Delo (USSR), no. 2, 1974 p 44-45 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Marine Transport Hygiene, Leningrad

(Contract NASw-3198)

(NASA-TM-76550) Avail: NTIS HC A02/MF A01 CSCL 20A

The individual exposure integral noise load on workers before the beginning of hearing impairment was determined for a group of 20 male miners who had worked with drilling equipment and harvesters for 8 to 20 years before the onset of the disability. Results show that the total exposure energy load of about 4 kw x h sq m, obtained by miners in the examined group, resulted in occupational injury to the auditory organ (cochlear neuritis) in 75% of the cases. The equivalent energy level of noise computed according to the date of total energy load is roughly 99 db A, which significantly exceeds the permissible amount of 85 db A. There is a correlation ($r = 0.77$) between the integral exposure energy noise on the aural analyzer in the degree of increase in the total threshold for the mean speech range. A.R.H.

N81-22691# Desmatics, Inc., State College, Pa.

PRELIMINARY ANALYSIS OF MOTION SICKNESS INCIDENCE DATA

Carl A. Mauro and Dennis E. Smith Feb. 1981 25 p refs

(Contract N00014-79-C-0128)

(AD-A096750; TR-112-8) Avail: NTIS HC A02/MF A01 CSCL 06/19

This report analyzes motion sickness data obtained from experiments involving the Office of Naval Research motion generator. Based on the analysis, a mixture of two statistical populations has been postulated as an overall model of time to first emesis. GRA

N81-22692# Los Alamos Scientific Lab., N. Mex.

CANCER RISKS AFTER RADIATION EXPOSURES

George L. Voelz 1980 18 p refs Presented at the Conf. on the Relation of Environmental Pollution to the Cancer Problem, Lakewood, Colo., Sep. 1980

(Contract W-7405-eng-36)

(LA-UR-80-3669; CONF-8009126-1) Avail: NTIS HC A02/MF A01

A general overview of the effects of ionizing radiation on cancer induction is presented. The relationship between the degree of risk and absorbed dose is examined. Mortality from radiation-induced cancer in the US is estimated and percentages attributable to various sources are given. DOE

N81-22693*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ASSESSMENT OF ZERO GRAVITY EFFECTS ON SPACE WORKER HEALTH AND SAFETY
Nov. 1980 125 p refs
(Contract DE-AI01-79CH-10025)
(NASA-TM-82330; DOE/ER-10025/T1) Avail: NTIS HC A06/MF A01 CSCL 06S

One objective of the study is to assess the effects of all currently known deviations from normal of medical, physiological, and biochemical parameters which appear to be due to zero gravity (zero-g) environment and to acceleration and deceleration to be experienced, as outlined in the references Solar Power Satellites (SPS) design, by space worker. Study results include identification of possible health or safety effects on space workers either immediate or delayed due to the zero gravity environment and acceleration and deceleration; estimation of the probability that an individual will be adversely affected; description of the possible consequence to work efficiency in persons adversely affected; and description of the possible/probable consequences to immediate and future health of individuals exposed to this environment. A research plan, which addresses the uncertainties in current knowledge regarding the health and safety hazards to exposed SPS space workers, is presented. Although most adverse affects experienced during space flight soon disappeared upon return to the Earth's environment, there remains a definite concern for the long-term effects to SPS space workers who might spend as much as half their time in space during a possible five year career period. The proposed 90 day up/90 day down cycle, coupled with the fact that most of the effects of weightlessness may persist throughout the flight along with the realization that recovery may occupy much of the terrestrial stay, may keep the SPS workers in a deviant physical condition or state of flux for 60 to 100% of their five year career. DOE

N81-22694# California Univ., Berkeley. Lawrence Berkeley Lab.
IONIZING RADIATION RISKS TO SATELLITE POWER SYSTEMS (SPS) WORKERS IN SPACE
Dec. 1980 57 p refs
(Contract W-7405-eng-48)
(DOE/ER-0094) Avail: NTIS HC A04/MF A01

The radiation risks to the health of workers who will construct and maintain solar power satellites in the space environment were studied. The major efforts were: to evaluate the radiation environment estimated for the Reference System which could represent a hazard; to assess the possible somatic and genetic radiation hazards; and to estimate the risks to the health of SPS workers due to space radiation exposure, and to make recommendations based on these conclusions. Details are presented. DOE

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-22695 Texas A&M Univ., College Station.
THE EFFECTS OF INCREASED AMBIENT TEMPERATURE ON DUAL TASK PERFORMANCE Ph.D. Thesis
Robert Parker Bateman 1980 125 p
Avail: Univ. Microfilms Order No. 8107989

Eighteen males, ages 18 - 29, were exposed to wet bulb globe temperatures of 18.5, 28.6 and 32.9 degrees centigrade in three sessions, each of two hours duration. During the second hour, subjects' performance on the tracking task and on six secondary tasks, performed singly and in combination with the primary task were measured. Significant performance decrements due to increased ambient temperature were observed for the vigilance task, the reaction time test and the Stroop test. These constitute the least complex mental tasks. For the sedentary tasks, the subjects were able to thermoregulate quite successfully. The average increase in the body core temperature for the hottest condition was only 0.4 degress C. It appears, from these results, that complex mental tasks remain unaffected by ambient conditions that produce only minor changes in the physiological state. There was, however, a trend towards performance decrements for the most difficult tasks at the highest temperatures. Dissert. Abstr.

N81-22696*# Battelle Columbus Labs., Mountain View, Calif.
FATIGUE AND ASSOCIATED PERFORMANCE DECREMENTS IN AIR TRANSPORT OPERATIONS
E. Gene Lyman and Harry W. Orlady 31 Mar. 1981 36 p refs
(Contract NAS2-10060)
(NASA-CR-166167) Avail: NTIS HC A03/MF A01 CSCL 05E

A study of safety reports was conducted to examine the hypothesis that fatigue and associated performance decrements occur in air transport operations, and that these are associated with some combination of factors: circadian desynchronosis, duty time; pre-duty activity; sleep; work scheduling; workload; and environmental deprivation. The findings are based on a selected sample of reported incidents in which the reporter associated fatigue with the occurrence. In comparing the fatigue reports with a control set, significant performance decrements were found to exist related to time-of-day, awareness and attention to duty, less significantly, final phases of flights. The majority of the fatigue incidents involved such unsafe events as altitude deviations, takeoffs and landing without clearance, and the like. Considerations of duty and sleep are the major factors in the reported fatigue conditions. S.F.

N81-22697*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HOW A PILOT LOOKS AT ALTITUDE
Amos A. Spady, Jr. and Randall L. Harris, Sr. Apr. 1981 15 p refs Presented at the 1980 Aircraft Safety and Operating Probl. Conf., Hampton, Va., 5-7 Nov. 1980 Submitted for publication
(NASA-TM-81967; NASA-CP-2170; L-14440) Avail: NTIS HC A02/MF A01 CSCL 05I

Commercial pilot eye scanning data previously collected were reanalyzed to evaluate how pilots used the drum pointer altimeter. The results of these tests showed that the pilots seldom used the drum window apparently because it was difficult to read as indicated by average drum window dwell times of 0.6 sec. It is suggested that pilot scanning data be collected for other types of altimeters in order to find those with good scanning characteristics. T.M.

N81-22698# Illinois Univ., Champaign. Cognitive Psychophysiology Lab.
APPLICATIONS OF EVENT-RELATED BRAIN POTENTIALS IN HUMAN ENGINEERING Annual Progress Report
Emanuel Donchin and Christopher D. Wickens Nov. 1980 39 p refs
(Contract F49620-79-C-0233)
(AD-A097007; UILU-CPL80-1/AFO) Avail: NTIS HC A03/MF A01 CSCL 05/10

This report describes research partially or entirely conducted during the first year of the contract period. It describes experiments related to four basic categories of human performance research: attention (including both attention allocation and workload), subjective probability and expectancy, processing latency, and control movement. A series of appendices describes those portions of the research that have been completed. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-22699 Tennessee Univ., Knoxville.
THERMAL COMFORT CHARACTERISTICS OF TEXTILE APPAREL FABRICS Ph.D. Thesis
Kay Sanders Grise 1980 167 p
Avail: Univ. Microfilms Order No. 8108143

The fabrics were commercially-available textile materials that

would normally be worn during the winter months by persons while at home with sedentary to moderate activity levels. Nine fabrics of various fiber content and construction were investigated. Seven of the fabrics represented materials that could be used for an indoor jacket and two fabrics represented materials that could be used for a shirt or blouse. Each test was made at three different combinations of temperature and relative humidity to simulate conditions next to the skin and in the ambient environment. Saturated salt solutions were used to maintain a constant relative humidity. Results of the study indicate that the layering of the fabrics is the most significant factor in thermal insulation for the fabrics under investigation; insulation increases with an increase in air space. The temperature-relative humidity was also a significant factor in providing insulation.

Dissert. Abstr.

N81-22700*# Acurex Corp., Mountain View, Calif. Aerospace Systems Div.

STUDY FOR FABRICATION, EVALUATION, AND TESTING OF MONOLAYER WOVEN TYPE MATERIALS FOR SPACE SUIT INSULATION Final Report

Ellen B. Merrick May 1979 71 p

(Contract NAS2-9873)

(NASA-CR-166139; ACUREX-TR-79-156) Avail: NTIS HC A04/MF A01 CSCL 06K

An alternative space suit insulation concept using a monolayer woven pile material is discussed. The material reduces cost and improves the durability of the overgarment, while providing protection similar to that provided by multilayer insulation (MLI). Twelve samples of different configurations were fabricated and tested for compressibility and thermal conductivity as a function of compression loading. Two samples which showed good results in the initial tests were further tested for thermal conductivity with respect to ambient pressure and temperature. Results of these tests were similar to results of the MLI tests, indicating the potential of the monolayer fabric to replace the present MLI. A seaming study illustrated that the fabric can be sewn in a structurally sound seam with minimal heat loss. It is recommended that a prototype thermal meteroid garment be fabricated. M.G.

N81-22701*# Analytics, Inc., Willow Grove, Pa.

A HUMAN OPERATOR SIMULATOR MODEL OF THE NASA TERMINAL CONFIGURED VEHICLE (TCV) Final Report

Floyd A. Glenn, III and Stephanie M. Doane Washington NASA May 1981 124 p refs

(Contract NAS1-15983)

(NASA-CR-3421; TR-1463.01-A) Avail: NTIS HC A06/MF A01 CSCL 05H

A generic operator model called HOS was used to simulate the behavior and performance of a pilot flying a transport airplane during instrument approach and landing operations in order to demonstrate the applicability of the model to problems associated with interfacing a crew with a flight system. The model which was installed and operated on NASA Langley's central computing system is described. Preliminary results of its application to an investigation of an innovative display system under development in Langley's terminal configured vehicle program are considered.

A.R.H.

N81-22702# Pennsylvania Univ., Philadelphia.

WORKSHOP ON INTERACTIVE MAN-MACHINE DISCOURSE

Aravind K. Joshi 1980 55 p refs Workshop held at Philadelphia, 17-20 Jun. 1980

(Grant N00014-80-G-0054; NR Proj. 049-458)

(AD-A096512) Avail: NTIS HC A04/MF A01 CSCL 05/8

This workshop was organized to discuss some critical issues in the design of interactive natural language system that have not received the careful attention that they deserve. Two of the sessions had as their topics, issues we felt are primary forcing functions in the design of interactive systems capable of responding to, and responding in, natural language. These forcing functions involve the purpose of the interaction, the 'social' conventions assumed by each participant, and the characteristics of the channel through which interaction takes place. The topic of the third session was the future of natural language communication with machines. GRA

N81-22703# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.

EVALUATION OF THE PROTECTIVE EFFICIENCY OF A NEW OXYGEN MASK FOR AIRCRAFT PASSENGER USE TO 4000 FEET

D. deSteiguer and J. J. Saldivar Oct. 1980 33 p refs

(AD-A097046; FAA-AM-80-18) Avail: NTIS HC A03/MF A01 CSCL 06/11

This report describes the methods used in the evaluation of a new continuous-flow, phase-dilution passenger oxygen mask for compliance to FAA Technical Standard Order (TSO)-C64 requirements. Data presented include end expiratory partial pressures for oxygen, carbon dioxide, and nitrogen at selected altitudes and oxygen flow rates. Data indicate that the test mask does meet the requirements for TSO-C64 certification.

GRA

N81-22704# Mitre Corp., Bedford, Mass.

MAN-MACHINE INTERFACE (MMI) REQUIREMENTS DEFINITION AND DESIGN GUIDELINES Progress Report

Sidney L. Smith Feb. 1981 83 p refs

(Contract F19628-80-C-0001; AF Proj. 572R)

(AD-A096705; MTR-8134; ESD-TR-81-113) Avail: NTIS HC A05/MF A01 CSCL 05/8

A previous report, asserted the need for man-machine interface (MMI) requirements definition and guidelines in the design of computer-based information systems. The present report extends the treatment of that topic. An initial hierarchic list of functional MMI capabilities, previously proposed for use in requirements definition, is here doubled in size to over 400 items, and has been reorganized to improve its structure. Initial design guidelines proposed for data entry functions are here revised and enlarged to include 79 items. Another 131 guidelines are proposed for sequence control functions. A continuation of guidelines development is recommended, in collaboration with other concerned organizations and agencies. GRA

N81-22705# European Space Agency, Paris (France).

COMPATIBILITY TEST OF OXYGEN EXPOSURE IN THE RANGE 2.2 TO 2.8 BAR ABS

Horst Krekeler, Pierre Cabarou, and Hans-Dietrich Fust Mar. 1981 33 p refs Trans. into ENGLISH of 'Untersuchung zur Vertraeglichkeit der Sauerstoffatmung im Bereich von 2.2 bis 2.8 bar abs", Rept. DFVLR-FB-78-10 DFVLR, Bonn, Feb. 1978

(ESA-TT-566; DFVLR-FB-78-10) Avail: NTIS HC A03/MF A01

Decompression tables for the range of diving depths between 100 and 200 m were developed and tested in a pressure chamber. Helium/oxygen mixtures with a maximum oxygen partial pressure of 2.5 bar abs. were breathed during the decompression. The effect of oxygen on the human organism and especially on the respiratory system was studied. Subjects were made to breathe pure oxygen for five days (Monday through Friday) during two conservative weeks, the oxygen pressures corresponding to 18 m for thirty minutes, to 15 m for sixty minutes, and to 12 m for ninety minutes on each occasion, i.e., three hours of oxygen breathing per day. No evidence whatsoever of any harmful effects due to the oxygen breathing was found. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N81-22706# Fermi National Accelerator Lab., Batavia, Ill.
MICROCOMPUTER/CYBER DATA TRANSFER SYSTEM
Duane C. Voy 12 Feb. 1981 5 p
(Contract DE-AC02-76CH-03000)
(DOE/CH-03000/T2; TM-1027) Avail: NTIS
HC A02/MF A01

A software system was developed to facilitate the transmission of ASCII text and data files between the Fermilab CYBER computer system and CP/M compatible Z80 microcomputers such as the Cromemco Z2. Communication between computers is via the dial up service of the CYBER system. Two programs for the microcomputer, UPLOAD and DOWNLOAD, transmit files to and receive files from the CYBER, respectively. Both programs allow the microcomputer operator to enter an interactive mode with the CYBER system for log-in sequences, etc. The microcomputer programs, once log-in sequences are completed, evoke a CYBER procedure that activates any files to be read or creates any files to be written. Descriptions of each microcomputer program and a copy of an example UPLOAD/DOWNLOAD session are given. DOE

N81-22707# Mayo Clinic, Rochester, Minn.
COMPUTER AIDED WIREWRAP INTERCONNECT Interim Report, 1 Jul. 1979 - 30 Jun. 1980
Barry K. Gilbert Wright-Patterson AFB, Ohio AFWAL Nov. 1980 321 p refs
(Contract F33615-79-C-1875; AF Proj. 6096)
(AD-A097014; AFWAL-TR-80-1161) Avail: NTIS
HC A14/MF A01 CSCL 09/5

This document is the first year final report for a three year program to refine and develop Computer Aided Design protocols for implementation of subnanosecond Emitter Coupled Logic in High Speed Computer Modules using a wirewrap interconnection medium. The software and user manual for implementation guides are not part of the actual report. GRA

N81-22708# Aeronautical Research Labs., Melbourne (Australia).
ARL HYBRID COMPUTING SYSTEM CONSOLE FUNCTIONS
H. A. Thelander Mar. 1980 30 p refs
(AD-A096541; ARL/SYS-NOTE-72) Avail: NTIS
HC A03/MF A01 CSCL 09/2

The interactive control and monitoring functions provided for the console operation of the analogue section of the ARL HCS3 hybrid computing system are described. These functions permit direct user control of all computing elements and provide for continuous display of operational states and error conditions, and for selection and readout of any analogue quantity. The functions facilitate the programming and testing of the analogue part of hybrid computations and provide capabilities for hardware maintenance. GRA

N81-22709# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
C-MU VOTER CHIP
Stephen R. McConnel and Daniel P. Siewiorek 10 Mar. 1980 20 p
(Contract N00014-77-C-0500)
(AD-A096590; CMU-CS-80-107) Avail: NTIS
HC A02/MF A01 CSCL 09/2

A CMOS LSI chip developed for implementation of bus-level voters is described. Special features based on experience with C.vmp, a SSI/MSI TTL prototype system, are presented and explained. This document provides all information necessary to design triplicated microcomputer systems using this chip as the basis of the voter circuit. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-22710 Texas A&M Univ., College Station.
SIMPLIFICATION OF MULTIPLE-OUTPUT BOOLEAN FUNCTIONS USING AN EXTENSION OF THE DIRECTED SEARCH ALGORITHM Ph.D. Thesis
Sharon Ruth Perkins 1980 84 p
Avail: Univ. Microfilms Order No. 8101633

An approach to minimization of multiple output combinational systems, based on the directed search algorithm designed for the single output system is considered. The directed search algorithm is extended to minimize multiple output systems. Unlike most minimization techniques, the algorithm does not identify and select implicants in two separate operations, but rather, it identifies and selects implicants in a single operation. Dissert. Abstr.

N81-22711 Carnegie-Mellon Univ., Pittsburgh, Pa.
CONTROL AND COMMUNICATION IN PROGRAMMED SYSTEMS Ph.D. Thesis
Loretta Guarino Reid 1980 173 p
Avail: Univ. Microfilms Order No. 8107886

A model of communication consisting of primitive objects and communication operations is developed in order to study communication properties of systems. Some of the goals of the design of the model were to permit the dynamic creation and destruction of pieces of systems, to permit the description of systems programmed in a wide variety of languages and implemented on a wide range of architectures, and to provide some support for flexibility and the localization of communication knowledge in-systems. Dissert. Abstr.

N81-22712 Carnegie-Mellon Univ., Pittsburgh, Pa.
A COMPUTER ARCHITECTURE FOR THE DYNAMIC OPTIMIZATION OF HIGH-LEVEL LANGUAGE PROGRAMS Ph.D. Thesis
Samuel Pollock Harbison, III 1980 177 p
Avail: Univ. Microfilms Order No. 8107880

TM, a computer architecture that dynamically performs many optimizations commonly seen in optimizing compilers, including common subexpression elimination, code motion, and register allocation is described. The architecture is based on an efficient, stack-oriented instruction set and is augmented with a special cache that holds the values of expressions and their dependencies. Experiments comparing the performance of TM and the traditional register architecture on a set of test programs show that a simple, nonoptimizing compiler can generate object code for TM that is smaller and faster than the code produced by an optimizing compiler for the register architecture. A cost analysis shows that TM's hardware mechanisms need not be expensive in comparison with traditional architectures and that the savings in compiler development costs are significant. Additional experiments investigate cache behavior and analyze alternative implementations. Dissert. Abstr.

N81-22713 California Univ., Irvine.
EXCEPTION HANDLING AND RECOVERY IN APPLICATIVE SYSTEMS Ph.D. Thesis
Wilfred Edmund Plouffe, Jr. 1980 110 p
Avail: Univ. Microfilms Order No. 8106787

Applicative models for designing new computer systems are

addressed. An exception handling and recovery model is presented based upon the following principles: (1) the preservation of the semantic base of the applicative system, even in the presence of exception conditions; (2) the definition of an error value; (3) the avoidance of non-terminating computations caused by the presence of exception conditions; and (4) the definition of distinguishing syntax for exception handling so that exception handling is distinct from the normal program flow. These principles are examined in detail within the context of two applicative systems: FP, an applicative language and Id, a dataflow language. It is shown that the model combines the expressive power of both a forward error recovery model and a backward error recovery model for von Neumann systems. However, the recovery system for applicative models is both simpler to understand and to implement than a recovery system for a von Neumann system. Finally, the basic model is extended for dataflow streams.
Dissert. Abstr.

N81-22714 California Univ., Irvine.
EFFICIENT ALGORITHMS WITH THREADED BALANCED TREES Ph.D. Thesis
Dov Harel 1980 144 p
Avail: Univ. Microfilms Order No. 8106778

A finger is a point in a file near which updates and searches can be conducted particularly efficiently. A data structure is presented based on weight balanced trees which supports insertions, deletions, searches, and approximate range queries. In each case both a finger f and a key k are specified as arguments to the appropriate algorithm. The total time bound for n updates (insertions or deletions) in an initially empty data structure is the sum over all updates of O(log d + log n) where d is the linear distance from f to k. The time for each individual search or range query is O(log d) will then show how to guarantee that each indivual update is performed efficiently by showing how binary trees of bounded balance can be updated with a guaranteed time bound of O(log n) per update. Dissert. Abstr.

N81-22715 California Univ., Irvine.
SOFTWARE CONSTRUCTION USING COMPONENTS Ph.D. Thesis
James Milne Neighbors 1980 217 p
Avail: Univ. Microfilms Order No. 8106784

The appropriate use of software components is investigated by analogy to the classical engineering question of whether to build an object out of custom made parts or standard parts and assemblies. The same analogy is used to explain some of the problems with previous work on reusable software. The result of reasoning with the engineering analogy is that the reuse of software results only from the reuse of analysis, design, and code; rather than just the reuse of code. The concept of domain analysis is introduced to describe the activity of identifying the objects and operations of a class of similar systems in a particular problem domain. A domain analysis is represented by a domain specific language, a prettyprinter, source to source transformations, and software components. Dissert. Abstr.

N81-22716 California Univ., Irvine.
PROGRAMMING TRICKS OF LAST RESORT FOR DESPERADOS: AN INVESTIGATION INTO THE ADVANTAGES OF ASSEMBLY LANGUAGE CODING Ph.D. Thesis
David Feign 1980 444 p
Avail: Univ. Microfilms Order No. 8106773

The limitations of higher order languages are illustrated by examining a representative efficient combination of a language (HAL/S) and its optimizing compiler. Its performance is compared with assembly language coding. Although the overall performance of the compiler is good, there are dramatic improvements that can be achieved at the assembly language level. Some possible improvements to the compiler are demonstrated. A classified catalog of ideas that can be used to reduce memory and execution time is presented. Some of these ideas may suggest features to be incorporated into higher order languages. Others may be used by compilers. This catalog can be viewed as the foundation for a larger collection that should be recorded before the tricks are forgotten and have to be reinvented. Dissert. Abstr.

N81-22717 Illinois Univ. at Chicago Circle, Chicago.
ZOOMING TECHNIQUES AND PICTURE ALGEBRA FOR PICTORIAL DATABASE INTERFACE Ph.D. Thesis
Bao-Shuh Paul Lin 1980 327 p
Avail: Univ. Microfilms Order No. 8106855

An integrated approach for designing a pictorial database system is proposed to handle both nonpictorial data and pictorial data in a uniform way in order to allow greater flexibility for pictorial information retrieval. The distinction of logical view and physical view of picture objects is discussed. A picture algebra is defined to manipulate the regional picture object, linear picture object, point picture object, and even the combination of these picture objects. In addition to physical zooming for enlarging a picture object, logical zooming technique is more important to allow users to navigate into the detailed description of this picture object or to browse through picture objects similar to this referred picture object. A hierarchical representation for the handling of spatial data in order to support the logical zooming technique is then described. Dissert. Abstr.

N81-22718 Georgia Inst. of Tech., Atlanta.
ON MUTATION Ph.D. Thesis
Allen Troy Acree, Jr. 1980 184 p
Avail: Univ. Microfilms Order No. 8107280

Several factors important in the feasibility and reliability of mutation analysis as a program testing technique are studied. In the course of investigating the coupling effect, over a million complex mutants were subjected to test data sufficient for first order mutation. All but 45 of these were either eliminated by the test data or proved to be equivalent to the original programs. Most of the 45 could be addressed within the framework of mutation analysis by the addition of a mutagenic operator. An experiment on the human evaluation of equivalence (of mutants to original programs) produced inconclusive results, but indicates the need for caution in the practice of mutation analysis in the step of judging mutants equivalent. A study of mutagenic operator efficiencies indicates that mutation analysis can be performed on compiled programs, rather than being limited to interpretive execution. Dissert. Abstr.

N81-22719 Pennsylvania Univ., Philadelphia.
MODULARITY IN NON-PROCEDURAL LANGUAGES THROUGH ABSTRACT DATA TYPES Ph.D. Thesis
Rajeev Sangal 1980 161 p
Avail: Univ. Microfilms Order No. 8107795

Abstract data types are proposed as a means of introducing modularity in nonprocedural languages. Notion of module for the specification of abstract data types is introduced and its denotational semantics is given. Nopal, a nonprocedural language for the specification of testing of electrical circuits, was chosen in which abstract data types are introduced for modularity. The abstract data types also allow specification of virtual devices in testing. An implementation of the Nopal processor is given. The Nopal processor analyzes a Nopal specification for completeness, consistency, and non-ambiguity; and generates a sequential program in Equate Atlas corresponding to the specification. The various phases of the Nopal processor for the analysis of a specification are described. Finally, some example specifications together with their generated Equate Atlas programs are given.
Dissert. Abstr.

N81-22720 Pennsylvania Univ., Philadelphia.
INFINITE STRUCTURES IN PROGRAMMING LANGUAGES Ph.D. Thesis
Thomas J. Myers 1980 206 p
Avail: Univ. Microfilms Order No. 8107780

Infinite structures (streams, infinite arrays, infinite trees), used in the semantics of ordinary programming languages and in mathematical description of problems, are examined. Standard semantic constructions are rephrased so that they can be brought into a programming language with a standard set of operators for structure generation, transformation, and consumption. A programming language is then designed on this basis, and the use of standardized operators rather than recursion is shown to have benefits similar to those gained with structured procedural programs rather than explicit branches. Finally, an implementation for a syntactic variant of the language is developed, and possible extensions are discussed. Dissert. Abstr.

N81-22721 Pennsylvania Univ., Philadelphia.
A SKELETAL AUTOMATON APPROACH TO THE INFERENCE PROBLEM FOR CONTEXT-FREE LANGUAGES Ph.D. Thesis
Leona Frances Fass 1980 202 p
Avail: Univ. Microfilms Order No. 8107742

The inference problem for context-free languages is approached from an automata-theoretic point of view, through the inference of the skeletal automata described by Levy and Joshi. Techniques for constructing finite state machines from specifications of their behavior are adapted to this class of tree automata which have, as their behavior, sets of skeletons (trees labelled only on their frontier nodes). It is shown that when a bound on the number of states of the automation is known, the minimal machine may be inferred from a finite sample of its behavior. Since these automata are known to recognize exactly the sets of skeletons of derivation trees of context-free languates, a consequence of this machine inference is grammatical inference. Given a suitably chosen finite sample of the derivation trees of good words in a context-free language, it is shown that a grammar for the language may be obtained from the resultant inferred skeletal automaton. Thus the language will be learned from a finite (structured) sample of its words. Dissert. Abstr.

N81-22722*# Systems Control, Inc., Palo Alto, Calif.
DEKFIS USER'S GUIDE: DISCRETE EXTENDED KALMAN FILTER/SMOOTHER PROGRAM FOR AIRCRAFT AND ROTORCRAFT DATA CONSISTENCY
Nov. 1979 69 p
(Contract NAS1-14549)
(NASA-CR-159081) Avail: NTIS HC A04/MF A01 CSCL 09B

The computer program DEKFIS (discrete extended Kalman filter/smoother), formulated for aircraft and helicopter state estimation and data consistency, is described. DEKFIS is set up to pre-process raw test data by removing biases, correcting scale factor errors and providing consistency with the aircraft inertial kinematic equations. The program implements an extended Kalman filter/smoother using the Friedland-Duffy formulation. M.G.

N81-22723*# Systems Control, Inc., Palo Alto, Calif.
SCI IDENTIFICATION (SCIDNT) PROGRAM USER'S GUIDE
Nov. 1979 50 p
(Contract NAS1-14549)
(NASA-CR-159082) Avail: NTIS HC A03/MF A01 CSCL 09B

The computer program Linear SCIDNT which evaluates rotorcraft stability and control coefficients from flight or wind tunnel test data is described. It implements the maximum likelihood method to maximize the likelihood function of the parameters based on measured input/output time histories. Linear SCIDNT may be applied to systems modeled by linear constant-coefficient differential equations. This restriction in scope allows the application of several analytical results which simplify the computation and improve its efficiency over the general nonlinear case. M.G.

N81-22724*# Systems Control, Inc., Palo Alto, Calif.
NLSCIDNT USER'S GUIDE MAXIMUM LIKEHOOD PARAMETER IDENTIFICATION COMPUTER PROGRAM WITH NONLINEAR ROTORCRAFT MODEL
Nov. 1979 121 p refs
(Contract NAS1-14549)
(NASA-CR-159083) Avail: NTIS HC A06/MF A01 CSCL 09B

A nonlinear, maximum likelihood, parameter identification computer program (NLSCIDNT) is described which evaluates rotorcraft stability and control coefficients from flight test data. The optimal estimates of the parameters (stability and control coefficients) are determined (identified) by minimizing the negative log likelihood cost function. The minimization technique is the Levenberg-Marquardt method, which behaves like the steepest descent method when it is far from the minimum and behaves like the modified Newton-Raphson method when it is nearer the minimum. Twenty-one states and 40 measurement variables are modeled, and any subset may be selected. States which are not integrated may be fixed at an input value, or time history data may be substituted for the state in the equations of motion. Any aerodynamic coefficient may be expressed as a nonlinear polynomial function of selected 'expansion variables'. M.G.

N81-22725*# Systems Control, Inc., Palo Alto, Calif.
SCI MODEL STRUCTURE DETERMINATION PROGRAM (OSR) USER'S GUIDE
Nov. 1979 29 p
(Contract NAS1-14549)
(NASA-CR-159084) Avail: NTIS HC A03/MF A01 CSCL 09B

The computer program, OSR (Optimal Subset Regression) which estimates models for rotorcraft body and rotor force and moment coefficients is described. The technique used is based on the subset regression algorithm. Given time histories of aerodynamic coefficients, aerodynamic variables, and control inputs, the program computes correlation between various time histories. The model structure determination is based on these correlations. Inputs and outputs of the program are given. M.G.

N81-22726*# Systems Control, Inc., Palo Alto, Calif.
INDES USER'S GUIDE MULTISTEP INPUT DESIGN WITH NONLINEAR ROTORCRAFT MODELING
Nov. 1979 54 p ref Sponsored in part by Army
(Contract NAS1-14549)
(NASA-CR-159085) Avail: NTIS HC A04/MF A01 CSCL 09B

The INDES computer program, a multistep input design program used as part of a data processing technique for rotorcraft systems identification, is described. Flight test inputs base on INDES improve the accuracy of parameter estimates. The input design algorithm, program input, and program output are presented. M.G.

N81-22727*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
A STUDY OF REAL-TIME COMPUTER GRAPHIC DISPLAY TECHNOLOGY FOR AERONAUTICAL APPLICATIONS Progress Report, 1 Oct. 1980 - 31 Mar. 1981
S. A. Rajala 30 Apr. 1981 67 p refs
(Grant NsG-1355)
(NASA-CR-164221) Avail: NTIS HC A04/MF A01 CSCL 09B

The development, simulation, and testing of an algorithm for anti-aliasing vector drawings is discussed. The pseudo anti-aliasing line drawing algorithm is an extension to Bresenham's algorithm for computer control of a digital plotter. The algorithm produces a series of overlapping line segments where the display intensity shifts from one segment to the other in this overlap (transition region). In this algorithm the length of the overlap and the intensity shift are essentially constants because the transition region is an aid to the eye in integrating the segments into a single smooth line. E.A.K.

N81-22728*# National Aeronautics and Space Administration, Washington, D. C.
ENSURING THE RELOCATABILITY OF PROGRAMS IN THE OPERATIONAL SYSTEM DOS YeS
S. K. Novoseltsev, I. G. Orlov, and A. S. Chesalin Oct. 1979 14 p Transl. into ENGLISH of 'Obespecheniye Permeshayemosti Programm v Operatsionnoy Sisteme DOS YeS" Rept. Pr-493 Moscow, 1979 13 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-75682; Pr-493) Avail: NTIS HC A02/MF A01 CSCL 09B

Specific modifications in the Disk Operational System Unified Series to insure the relocatability of programs stored permanently in the core image library is described. A self-relocating method for loading programs into the working memory with re-editing all the programs recorded in the core image library is presented. The modified linkage editor can be included in a relocation dictionary containing data about each address constant at the assembly stage at the request of the programmer. The relocation dictionary increases the dimension of the RL-phase in comparison with the dimension of this same phase when edited by the

standard method, making possible the creation of multiphase program complexes. Generation and use of the modified system using Assembly language is described. An example of the use of the system is given, and limitations of the use of the relocatable programs in the modified system are outlined. J.D.H.

N81-22729# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.

QUALITY METRICS OF DIGITALLY DERIVED IMAGERY AND THEIR RELATION TO INTERPRETER PERFORMANCE Annual Technical Report, 1 Oct. 1979 - 30 Sep. 1980

Harry L. Snyder 30 Sep. 1980 22 p

(Contract F49620-78-C-0055; AF Proj. 2313)

(AD-A096950; AFOSR-81-0304TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This annual report describes the year's progress of a research program that will determine the validity of quality metrics of digital imagery and relate these metrics to image interpreter performance with both hard-copy and soft-copy displays. Separate technical reports are issued to cover major elements of work under this contract. This annual report simply summarizes work performed to date. GRA

N81-22730# General Electric Co., Arlington, Va. Information Systems Programs Dept.

THE EFFECTS OF THE SYMBOLOGY AND SPATIAL ARRANGEMENT OF SOFTWARE SPECIFICATIONS IN A CODING TASK

Sylvia B. Sheppard and Elizabeth Kruesi Feb. 1981 50 p refs

(Contract N00014-79-C-0595; NR Proj. 196-160)

(AD-A097029; TR-81-388200-3) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the second in a series of experiments to evaluate the effects of the format of software specifications on programmer performance. The current experiment examined performance on a coding task. Thirty-six professional programmers were presented with specifications for each of three modular-sized programs. Nine different specification formats were prepared for each program. These formats varied along two dimensions: type of symbology and spatial arrangement. The type of symbology included natural language, constrained language (PDL), and ideograms (flowchart symbols). The spatial arrangement included sequential (vertical flow), branching (flowchart), and hierarchical (tree-like). Working from the specifications, the participants constructed a section of code at the middle of each program. These sections contained about fifteen lines and included the most complex decision structures present in the programs. The participants were instructed to complete the code, using a text editor. When satisfied that the program would perform correctly, they submitted it for a compilation and run. If the compilation was unsuccessful or the program did not run correctly, the participants were asked to correct the errors and submit the run again. GRA

N81-22731# Texas A&M Univ., College Station.

APPLICATION OF A SPECIALIZED STATISTICAL COMPUTER PROGRAM, ALPHAF, TO A SENSORY EVOKED RESPONSE DATA ANALYSIS SYSTEM Final Report

James M. Verlander 3 Feb. 1980 12 p

(Grant AF-AFOSR-3687-78; AF Proj. 2312)

(AD-A096997; AFOSR-81-0296TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

An investigation of the application of a specialized computer program to the study of sensory evoked responses was completed. The purpose of the study was to determine the applicability of the program in assessing aircrew performance. The study indicated that the averaged evoked response, the fast Fourier transform and a specialized program, ALPHAF, could not detect very early conditions of hypoxia and are therefore not applicable to assessment of aircrew performance. GRA

N81-22732# Stanford Univ., Calif. Dept. of Computer Science.

RLL-1: A REPRESENTATION LANGUAGE LANGUAGE

Russell Greiner Oct. 1980 46 p refs

(Contract N00014-80-C-0609)

(AD-A096510; HPP-80-9) Avail: NTIS HC A03/MF A01 CSCL 09/2

The field of AI is strewn with knowledge representation languages. The language designer typically designs that language with one particular application domain in mind; as subsequent types of applications are tried, what had originally been useful features are found to be undesirable limitations, and the language is overhauled or scrapped. One remedy to this bleak cycle might be to construct a representation language whose domain is the field of representational languages itself. Toward this end, we designed and implemented RLL-1, a frame-based Representation Language Language. The components of representation languages in general (such as slots and inheritance mechanisms) and of RLL-1 itself, in particular, are encoded declaratively as frames. By modifying these frames, the user can change the semantics of RLL-1's components, and significantly alter the overall character of the RLL-1 environment. Often a large Artificial Intelligence project begins by designing and implementing a high-level language in which to easily and precisely specify the nuances of the task. The language designer typically builds his Representation Language around the one particular highlighted application, such as molecular biology for Units (Stefik), or natural language understanding for KRL (Bobrow, Winograd) and OWL (Szolovits, et al.). For this reason, his language is often inadequate for any subsequent applications, except those which can be cast in a form similar in structure to the initial task. What had originally been useful features are subsequently found to be undesirable limitations. Consider Units' explicit copying of inherited facts or KRL's sophisticated but slow matcher. GRA

N81-22733# Wisconsin Univ. - Madison. Mathematics Research Center.

LEAST-NORM LINEAR PROGRAMMING SOLUTION AS AN UNCONSTRAINED MINIMIZATION PROBLEM

O. L. Mangasarian Dec. 1980 20 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-79-01066)

(AD-A096664; MRC-TSR-2147) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that the dual of the problem of minimizing the 2-norm of the primal and dual optimal variables and slacks of a linear program, can be transformed into an unconstrained minimization of a convex, parameter-free, globally differentiable, piecewise quadratic function with a Lipschitz continuous gradient. If the slacks are not included in the norm minimization, one obtains a minimization problem with a convex, parameter-free, quadratic objective function subject to nonnegativity constraints only. Author (GRA)

N81-22734# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

COHERENT BEHAVIOR FROM INCOHERENT KNOWLEDGE SOURCES IN THE AUTOMATIC SYNTHESIS OF NUMERICAL COMPUTER PROGRAMS

Richard Brown Jan. 1981 211 p refs

(Contract N00014-80-C-0505)

(AD-A096559; AI-TR-610) Avail: NTIS HC A10/MF A01 CSCL 09/2

A fundamental problem in artificial intelligence is obtaining coherent behavior in rule-based problem solving systems. A good quantitative measure of coherence is time behavior; a system that never, in retrospect, applied a rule needlessly is certainly coherent; a system suffering from combinatorial blowup is certainly behaving incoherently. This report describes a rule-based problem solving system for automatically writing and improving numerical computer programs from specifications. GRA

N81-22735# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE DEFINITION AND IMPLEMENTATION OF A COMPUTER PROGRAMMING LANGUAGE BASED ON CONSTRAINTS Ph.D. Thesis

Guy Lewis Steele, Jr. Aug. 1980 375 p refs

(Contract N00014-80-C-0505)

(AD-A096556; AI-TR-595) Avail: NTIS HC A16/MF A01 CSCL 09/2

The constraint paradigm is a model of computation in which values are deduced whenever possible, under the limitation that deductions be local in a certain sense. One may visualize a

constraint 'program' as a network of devices connected by wires. Data values may flow along the wires, and computation is performed by the devices. A device computes using only locally available information (with a few exceptions), and places newly derived values on other, locally attached wires. In this way computed values are propagated. An advantage of the constraint paradigm (not unique to it) is that a single relationship can be used in more than one direction. The connections to a device are not labelled as inputs and outputs; a device will compute with whatever values are available, and produce as many new values as it can. General theorem provers are capable of such behavior, but tend to suffer from combinatorial explosion; it is not usually useful to derive all the possible consequences of a set of hypotheses. The constraint paradigm places a certain kind of limitation on the deduction process. A number of implementations of constraint-based programming languages are presented. GRA

N81-22736# Stanford Univ., Calif. Dept. of Computer Science.
RLL-1: A REPRESENTATION LANGUAGE LANGUAGE. SUPPLEMENT: DETAILS OF RLL-1
Russell Greiner and Douglas B. Lenat Oct. 1980 67 p
(Contract N00014-80-C-0609)
(AD-A096779; HPP-80-23-Suppl) Avail: NTIS HC A04/MF A01 CSCL 09/2

This paper includes many implementation level details about the RLL-1 system, described in a companion paper, RLL-1: A Representation Language Language (Heuristic Programming Project Working Paper HPP-80-9, October 1980, at Stanford University, by Russell Greiner). The contents are as follows: Special Units, Naming conventions, Legend, Actual units, Index of Units, Environment, Top level Functions, Functions needed to Bootstrap RLL-1, Convenience Functions, Advised Functions, and Global Variables. GRA

N81-22737# South Carolina Univ., Columbia.
DATA STRUCTURE DEFINITION AND ACCESS CONTROL FACILITIES FOR LANGUAGES DESIGNED FOR THE DEVELOPMENT OF RELIABLE SOFTWARE Final Report, 20 Oct. 1979 - 19 Oct. 1980
Billy G. Claybrook and Anne-Marie Discepolo Feb. 1981 33 p refs
(Contract DAAG29-80-C-0022)
(AD-A096755; ARO-17157.1-EL) Avail: NTIS HC A03/MF A01 CSCL 09/2

The objective of the research reported here was to develop a specification method for the specification of abstract data types and an access control facility suitable for inclusion in high-level programming languages. The research was not intended to include the design of a complete language but instead involved the development of programming language features that aid in the development of languages designed for producing reliable software. A constructive specification method was developed for specifying abstract data types. Abstract data types are specified using the module encapsulation mechanism. A constructive specification consists of two parts: a logical structure specification and a semantics operations specification. The constructive specification method is described. GRA

N81-22004*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE P/POD PROJECT: PROGRAMMABLE/PILOT ORIENTED DISPLAY
James A. Littlefield *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 43-50 (For primary document see N81-21999 13-01)
Avail: NTIS HC A07/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N81-22738 Ohio State Univ., Columbus.
INTERCONNECTION DESIGN AND RESOURCE ASSIGNMENT FOR LARGE MULTI-MICROCOMPUTER SYSTEMS Ph.D. Thesis
Shyue Bin Wu 1980 285 p
Avail: Univ. Microfilms Order No. 8107415

Two issues in the design of large multi-microcomputer systems are addressed: how to design an interconnection structure in order to support interprocessor communication, and how to assign system resource, in order to make a large number of microcomputers function together as a single integrated system. A cluster structure is proposed as a conceptual scheme for interconnecting a large number of microcomputers. It is characterized by a set of structure parameters and a set of interconnection functions. Therefore, by specifying values for structure parameters and interconnection functions, one can specify a desired interconnection structure. An analytical model to analyze message delay and traffic congestion problems is proposed. This analysis considers the detailed interaction among system nodes. It shows the effect of structure topology on bus load and message delay. Through the use of the cluster structure and the analytical model, how one can find an optimal structural topology so that more microcomputers can be interconnected and/or more message traffic can be supported without suffering serious system degradation is demonstrated. Case studies are presented to show how topological optimization can be done subject to design constraints arising from system applications. Dissert. Abstr.

N81-22739 Texas A&M Univ., College Station.
APPROXIMATION ALGORITHMS FOR SCHEDULING TO MINIMIZE THE MAKESPAN OF COMMUNICATING PROCESSES ON SELECTED COMPUTER NETWORKS Ph.D. Thesis
Maxwell Sutherland Drew 1980 197 p
Avail: Univ. Microfilms Order No. 8108003

The problem of how to efficiently schedule a task system in which the precedent relation is a tree, on the processors of centralized and distributed loop computer network is addressed. In particular, the problem is investigated for the case in which there is a single task that must receive messages from all the other tasks before it can be executed. It is desired to find a schedule for which the makespan, the earliest time at which the tasks have completed execution, is minimal. It is shown that the problem is NP Hard when the tasks all execute in unit time, the message costs are arbitrary, a time efficient policy is used to routing message packets, and the network is a centralized, distributed loop, or topologically distributed store and forward computer network. Two approximation algorithms which produce near optimal schedules are investigated for the cases in which the system is executed on a centralized or distribution loop computer network. These cases are in fact shown to be equivalent. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N81-22740 Princeton Univ., N. J.
FREQUENCY RESPONSE SYNTHESIS OF MULTIVARIABLE FEEDBACK CONTROLLERS Ph.D. Thesis
Jeffrey Clair Kantor 1981 165 p
Avail: Univ. Microfilms Order No. 8107522

Several results for the synthesis of multivariable feedback controllers for linear systems are presented. The Nyquist array methodology of Rosenbrock is extended by definition of a scalar quantity theta (s) termed the Gershgorin radius. Theta (s) is a quantitative, scale invariant measure of interaction due to off diagonal elements in the open loop transfer function. A second scalar quantity termed the robust Gershgorin radius is defined and used for the stability analysis of perturbed closed loop systems and a method for the synthesis of robust feedback controllers is proposed. The special case of systems subjected to sensor and actuator failures is treated in detail. The utility of theta (s) and robust theta (2) as measures of interaction in multivariate systems is discussed and compared to the Relative Gain Array proposed by Bristol. Finally, a particular structure for the feedback control that incorporates a process model is proposed for systems with

large time delays. This control structure is compared to optimal feedback, observer feedback, and the multivariable Smith predictor for which process models are integral components. A method for the robust synthesis of the proposed control system is then presented. Dissert. Abstr.

N81-22741# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
A CELLULAR AUTOMATA APPROACH TO COMPUTER VISION AND IMAGE PROCESSING Ph.D. Thesis
George Daniel Hadden Sep. 1980 251 p refs
(Contract N00014-75-C-0612)
(AD-A096569; T-100) Avail: NTIS HC A12/MF A01 CSCL 09/4

In the HEXVIS system, which performs operations on scenes, all operations are carried out in a hexagonal array of cellular automata-like objects which corresponds to that scene. The system can perform (for instance) the following: recognition of edges, corners, and axes of symmetry, texture discrimination, determination of areas, and generation of Voronoi tessellations. The scene is first embedded in the hexagonal array, then the cells pass messages describing the cells' contents to their neighbors which, in turn, pass them on. As these messages pass through cells, they can interact with each other and with the contents of the cell in which they find themselves. The cells all perform the same operation or group of operations in parallel on their visiting messages. As a consequence of these operations, the states of some cells change in a way which indicates that they correspond to 'interesting' parts of the scene. This process can be repeated recursively using the altered states of the cells as new messages to be broadcast. A new algorithm embedded in HEXVIS, shrinks binary scenes in a hexagonal array. GRA

N81-22742# Stanford Univ., Calif. Dept. of Computer Science.
THE NATURE OF HEURISTICS
Douglas B. Lenat 29 Dec. 1980 31 p refs
(Contract N00014-80-C-0609; Grant NSF MCS-79-01954)
(AD-A096511; HPP-80-26) Avail: NTIS HC A03/MF A01 CSCL 09/2

The bottleneck of building expert systems is knowledge acquisition, and one long-range solution is for the program to learn via discovery. New domains of knowledge can be developed by using heuristics, yet as they emerge new heuristics are needed. They in turn can be discovered by using a body of heuristics for guidance. How exactly does this process work? Must there be a separate body of 'meta-heuristics'? How intertwined are heuristics with representation of knowledge? In trying to find new heuristics, is it cost-effective to try to improve the existing representation of knowledge, and if so how can this be automated? What is the nature of heuristics, their 'first-order theory'? What are the implications of such a theory upon the design of a program which discovers new heuristics? These questions are among those that our research and this paper address. GRA

N81-22743# Aeronautical Research Labs., Melbourne (Australia).
A MICROPROCESSOR CONTROLLED GRAPHICS DISPLAY SYSTEM
C. W. Sutton, J. F. Harvey, and G. A. Cleave Mar. 1980 38 p refs
(AD-A096540; ARL/AERO-NOTE-396) Avail: NTIS HC A03/MF A01 CSCL 09/2

A graphics display system is described which functions as a peripheral of a data acquisition system, connected on-line to a time shared central computer. Under control of the central computer, multichannel scaled co-ordinate graphs and displays are generated on a storage display unit by a 16 bit microprocessor. GRA

N81-22744# Lincoln Lab., Mass. Inst. of Tech., Lexington.
BIASED RESULTS WITH THE LEAVING-ONE-OUT METHOD OF PATTERN RECOGNITION
Lee K. Jones and Kenneth H. Wickwire 11 Dec. 1980 14 p ref
(Contract F19628-80-C-0002; AF Proj. 627A)
(AD-A096724; TR-545; ESD-TR-80-233) Avail: NTIS HC A02/MF A01 CSCL 05/8

We show that the leaving-one-out method of pattern recognition must yield biased results when the two sets of training data (representing two classes to be discriminated) are identical. This phenomenon, which we observed during a study of the sensitivity of classification results to errors in the training data, can be eliminated by generating the training sets independently. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-22745 Houston Univ., Tex.
A NEW ALGORITHM OVER THE COMPLEX NUMBER FIELD (AFC) AND ITS APPLICATIONS TO UNITS AND COMBINATORIAL IDENTITIES Ph.D. Thesis
Malvina Florica Baica 1980 97 p
Avail: Univ. Microfilms Order No. 8106899

A few classes of algebraic number fields of arbitrary degree n >or = 2 are considered and an algorithm (AFC) which operates in the complex field is constructed, whereby this algorithm applied to a vector of R(n-1) becomes periodic. Particular units are determined in a uniform way by means of periodic algorithm, satisfying in this way Hilbert's request for the disclosure of units. Some combinatorial identities are derived from units using Bernstein's method. This method is based entirely on the knowledge of explicit units in algebraic number fields of degree higher than two. It is not really necessary to make use of the theory of units to produce such combinatorial identities, but this method is interesting since it is capable of producing some results with simpler computations. Dissert. Abstr.

N81-22746 Vanderbilt Univ., Nashville, Tenn.
LIMIT CYCLE SOLUTIONS OF REACTION-DIFFUSION EQUATIONS Ph.D. Thesis
Davis Kelly Cope, Jr. 1980 321 p
Avail: Univ. Microfilms Order No. 8108272

Reaction-diffusion equations are studied; more specifically, systems of partial differential equations of the form u sub t = F(u) + K delta(2)u, where u is a vector, F(u) is a nonlinear vector function of u, and K is a constant nonnegative-definite matrix. The kinetic equations are assumed to possess a limit cycle solution u = U(t). The u = U(t) as a solution of the equation and certain related questions are examined. Dissert. Abstr.

N81-22747 California Univ., Santa Barbara.
DETERMINANTAL INEQUALITIES Ph.D. Thesis
Kenneth Lee Moore 1980 94 p
Avail: Univ. Microfilms Order No. 8107701

Homogeneous varieties of the Gauss algebra such as the Grassmanian manifold G sub m and the set of decomposable elements in the mth-tensor space D sub m, provide fundamental links between algebra and geometry. Syzygies among the components of the elements of such varieties can combinatorially reflect properties of space. Bilinear forms on G sub m and quadratic forms on D sub m are used to study determinantal inequalities arising from the quadratic relations and the Cauchy-Schwarz inequality. Dissert. Abstr.

N81-22748 California Univ., Irvine.
ALGEBRAIC GEOMETRY AND COMBINATORIAL GROUP THEORY WITH APPLICATIONS TO THE HURWITZ MONODROMY GROUP Ph.D. Thesis
Ronald Clayborne Biggers 1980 96 p
Avail: Univ. Microfilms Order No. 8106767

Covering space theory and standard techniques from combinatorial group theory are used to compute a particular orbit. It is noted that the irreducibility of certain moduli spaces is equivalent to this number being one and examples are given to show that this number is not always one. It is then shown how the irreducibility of a moduli space of simple covers implies the irreducibility a moduli space fibered over the moduli space of cyclic covers of degree of curves of genus g. Finally, it is shown that the existence of a fine moduli space corresponding to a given representation of the Hurwitz monodromy group can

be determined by the existence of a given group extension. Dissert. Abstr.

N81-22749 Georgia Inst. of Tech., Atlanta.
AN ALGORITHM FOR FINITE DIMENSIONAL APPROXIMATIONS OF SOLUTIONS TO INFINITE DIMENSIONAL PROBLEMS Ph.D. Thesis
Elaine Marjorie Hubbard 1980 83 p
Avail: Univ. Microfilms Order No. 8107284

Techniques for solving various types of constrained minimization problems in a finite dimensional setting are well known. One finite dimensional technique, the Frank Wolfe algorithm, is desirable because it involves relatively simple subproblems. One is a linear problem and the other is a nonlinear problem but one dimensional. When combined with projection methods the linear subproblem is also finite dimensional. In order to use this algorithm when the constraint set is not contained in a finite dimensional set several problems are encountered. The lack of compactness is a major problem because without compactness it is difficult to obtain convergence results. Another problem is the behavior of the derivatives of the objective function in the general case. In the special case when the objective function is associated with solving a linear operator equation, problems arise when the null space of he operator is not finite dimensional and when the range is not closed. Dissert. Abstr.

N81-22750 Missouri Univ. -Rolla.
ALGORITHMS FOR FIXED POINTS OF NONEXPANSIVE OPERATORS Ph.D. Thesis
Michael Donald Humphries 1980 52 p
Avail: Univ. Microfilms Order No. 8108111

Two algorithms for finding a fixed point of a nonexpansive self map of a closed, bounded, and convex set are described. The first is a special case of the Mann process. It averages two points which are relatively distant to obtain a better approximation to a fixed point. Under Browder's hypotheses, there is a fixed point which is the limit of a sequence of fixed points of contractions. The second algorithm uses Richardson extrapolation to accelerate the convergence of this sequence. Some results related to fixed point theory are discussed, particularly Brosowski's Theorem in approximation theory. Dissert. Abstr.

N81-22751 State Univ. of New York at Binghamton.
UNIFORM ASYMPTOTIC EXPANSIONS FOR SOLUTIONS TO ELECTROSTATIC, IDEAL FLOW, AND STOKES FLOW PROBLEMS EXTERIOR TO THIN OBLATE BODY OF REVOLUTION Ph.D. Thesis
Richard Norman Barshinger 1981 108 p
Avail: Univ. Microfilms Order No. 8107111

Several potential and fluid flow problems involving a thin, analytic, oblate body of revolution are studied. By using the thinness parameter of the body, the first three terms in the uniform asymptotic expansion of the solution to each problem are found. The body is assumed to have both a plane of symmetry perpendicular to the body axis and to have an analytic equation. The part of each solution generated by the presence of the body is represented as the superposition of point singularities distributed over a portion of the plane of symmetry and lying inside the body. The boundary condition on the surface of the body leads to one or more linear integral equations for the densities of the singularity distributions. These density functions are then expanded asymptotically. The extent of these distributions within the body is uniquely determined by requiring that the solution be uniformly valid near and even on the surface of the body as well as as far away. The results are then used to generate formulas for important physical quantities associated with the various problems discussed. Dissert. Abstr.

N81-22752 University of South Florida, Tampa.
ON SOLUTIONS OF POLYNOMIAL AND MATRIX EQUATIONS OVER THE RING OF P-ADIC INTEGERS Ph.D. Thesis
George Francis Mead, Jr. 1980 88 p
Avail: Univ. Microfilms Order No. 8108264

The properties of the p-adic numbers are studied and the p-acid integral solutions to certain polynomial equations whose coefficients are p-adic integers are investigated. Also investigated are the solutions of polynomial equations over the p-adic integers where the domain is the ring of p-adic integral matrices. The main techniques for solving these polynomial equations involve using the properties of the p-adic valuation, a non-Archimedean valuation, the properties of the field of p-adic numbers, and in particular the Hensel's lemma together with its generalization. Also used is a p-adic version of Eisenstein's irreducibility criterion together with some theorems on power residues and finite fields. Results and conclusions are reached as to the existence and number of p-adic integral solutions of these polynomials by examining certain conditions on the degree of the polynomial and the p-adic coefficients. Also found are additional p-adic irreducibility conditions and existence and number of p-adic integral matric solutions to certain polynomial equations when conditions are placed on the p-adic coefficients. Dissert. Abstr.

N81-22753 Tennessee Univ., Knoxville.
ON EIGENVALUE APPROXIMATIONS BY MIXED FINITE ELEMENT METHODS Ph.D. Thesis
Janet Sylvia Peterson 1980 84 p
Avail: Univ. Microfilms Order No. 8108168

The theory for the approximation of partial differential eigenvalue problems by mixed finite element methods is studied. Work by Osborn is extended and generalized to obtain eigenvalue error estimates for a general nonselfadjoint eigenvalue problem. Error estimates for the eigenvector approximations are shown to be easily obtainable. The error analysis for the abstract eigenvalue problem is applied to various examples to illustrate the theory. The first example is the energy stability of incompressible viscous flows while the second example is an acoustic eigenvalue problem for a fluid with a variable speed of sound which is contained in an enclosure. An additional example is analyzed to illustrate the nonselfadjoint aspect of the theory. In each of the examples the solution is approximated by mixed finite element methods which ultimately leads to a linear generalized eigenvalue problem to be solved. Numerical results for each example are presented which illustrate the abstract error estimate. Dissert. Abstr.

N81-22754*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TEMPORAL AND SPATIAL INCONSISTENCIES OF TIME-SPLIT FINITE-DIFFERENCE SCHEMES
Douglas L. Dwoyer and Frank C. Thames Apr. 1981 58 p refs
(NASA-TP-1790; L-13941) Avail: NTIS HC A04/MF A01 CSCL 12A

The properties of an implicit time-split algorithm, which utilizes locally one dimensional spatial steps, are examined using the two-dimensional heat conduction equation as the test problem. Both temporal and spatial inconsistencies inherent in the scheme are identified. A consistent, implicit splitting approach is developed. Therelationship between this method and other time-split implicit schemes is explained, and stability problems encountered with the method in three dimensions are discussed. M.G.

N81-22755*# National Aeronautics and Space Administration, Washington, D. C.
STEADY (ROBUST) CONDITIONALLY EFFECTIVE ESTIMATION OF PARAMETERS
L. S. Gurin and K. A. Tsoy Jun. 1980 14 p refs Transl. into ENGLISH of "Ustoychivyye (Robastnyye) Uslovno-Effektivnyye Otsenki Parаemtrov" Rept. Pr-382 Moscow, 1977 14 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-76218; Pr-382) Avail: NTIS HC A02/MF A01 CSCL 12A

The concept of conditionally-effective estimation which provides optimum estimates for a given criterion in cases of given limitations is examined. The concept has the best accuracy for given limitation on the suitability of the algorithm concerning the deviation of the law governing error distribution from the proposed law. It is concluded that there must be a greater difference between individual algorithms in terms of difficulty, and that for the linear regression problem algorithms based on excluding lost points should be studied. E.A.K.

N81-22756# Wisconsin Univ. - Madison. Mathematics Research Center.

TWO APPLICATIONS OF APPROXIMATE DIFFERENTIATION FORMULAE: AN EXTREMUM PROBLEM FOR MULTIPLY MONOTONE FUNCTIONS AND THE DIFFERENTIATION OF ASYMPTOTIC EXPANSIONS

I. J. Schoenberg Dec. 1980 21 p refs
(Contract DAAG29-80-C-0041)
(AD-A096662; MRC-TSR-2145) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report presents two further applications of very elementary formulae of approximate differentiation. The first is a new derivation in a somewhat sharper form of a theorem of V. M. Olovyanisnikov on multiply monotone functions. The second applications gives sufficient conditions for the differentiability of asymptotic expansions. GRA

N81-22757# Wisconsin Univ. - Madison. Mathematics Research Center.

RELATIVE CHEBYSHEV CENTERS IN NORMED LINEAR SPACES, PART 2

Dan Amir (Tel-Aviv Univ.) and Zvi Ziegler (Technion, Israel) Nov. 1980 30 p refs
(Contract DAAG29-80-C-0041)
(AD-A096660; MRC-TSR-2143-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let E be a normed linear space, A a bounded set in E, and G in an arbitrary set in E. The relative Chebyshev center of A in G is the set of points in G best approximating A. We have obtained elsewhere general results characterizing the spaces in which the center reduces to a singleton in terms of structural properties related to uniform and strict convexity. In this paper an analysis of the Chebyshev norm case, which falls outside the scope of the previous analysis, is presented. GRA

N81-22758# Stanford Univ., Calif. Dept. of Operations Research.

ON THE CONSECUTIVE K-OF-N SYSTEM

Cyrus Derman, Gerald J. Lieberman, and Sheldon M. Ross Dec. 1980 25 p refs
(Contracts N00014-75-C-0561; N00014-75-C-0620; N00014-77-C-0299; Grants AF-AFOSR-3213-77; NSF MCS-78-25146)
(AD-A096951; TR-197) Avail: NTIS HC A02/MF A01 CSCL 12/1

The consecutive k-of-n system is considered in which there are n components linearly ordered. Each component either functions or fails and the system is said to be failed if any k consecutive components are failed. Let r(p) = r(p sub 1, ..., p sub n) denote the probability that the system does not fail given that the components are independent, component i functions with probability p sub i, i = 1, ..., n. The function r(p) is called the reliability function. The above system is studied both when the components are linearly ordered and also when they are arranged in a circular order. In Section 2, the case is considered where all p sub i are identical and present a recursion for obtaining the reliability of a consecutive k-of-n in terms of the reliability of a consecutive k - 1 on n system. This yields simple explicit formulas when k is small and differs from the recursion obtained. In Section 3, we show how upper and lower bounds on r(p) can be simply obtained. In Section 4, we consider a dynamic version in which each component independently functions for random time having distribution F. We show that when F is increasing failure rate (IFR), then system lifetime is also IFR only in the circular case when k = 2. In Section 5, we consider a sequential optimization model in the linear k = 2 case. In this model, components are put in place one at a time with complete knowledge as to whether the previous component has worked or not. We show that the optimal policy is such that whenever a success occurs we follow it with the worst of the remaining components and whenever a failure occurs we follow it with the best of the remainder. GRA

N81-22759# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.

INITIAL-BOUNDARY VALUE PROBLEMS FOR HYPERBOLIC EQUATIONS AND THEIR DIFFERENCE APPROXIMATION WITH CHARACTERISTIC BOUNDARY Interim Report

Daniel Michelson Jun. 1980 202 p refs
(Grant AF-AFOSR-3651-78; AF Proj. 2307)
(AD-A097010; AFOSR-81-0253TR) Avail: NTIS HC A10/MF A01 CSCL 12/1

This work consists of two parts. In the first, we consider initial-boundary value problems for strictly hyperbolic systems with constant coefficients. By using the technique of lambda-matrix, we obtain an a priori estimate, which assures the continuous dependence of the solution on the inhomogeneous terms of the equations. This work generalizes the former results of Majda and Osher (1975) also to the nonsymmetrical case, simplifies their proofs and removes some of their assumptions. In Part 2, we develop stability theory for Burstein difference scheme approximating the above problem (m = 2) with additional assumption DET (A ALPHA + B2B) = 0. Particularly, the problem of constructing the Kreiss symmetrizer for general multidimensional dissipative approximations is resolved, thus removing the only obstacle in developing stability theory for such approximations in the noncharacteristic case. GRA

N81-22760# Colorado State Univ., Fort Collins. Dept. of Mathematics.

AN ADAPTIVE PIECEWISE CURVE-FITTING PACKAGE USING A LOOK AHEAD STRATEGY M.S. Thesis

David C. Platt and G. D. Taylor 1981 31 p refs
(Contract F49620-79-C-0124)
(AD-A096972; AFOSR-81-0310TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

An adaptive curve fitting algorithm for one dimensional data sets is developed and tested. This algorithm is a modification of two earlier curve fitting packages using the least squares L sub 2 or the L sub 1 approximation operator. This new algorithm performs a look ahead strategy in the 'backing off' routine for locating the knots joining the polynomial approximating pieces. GRA

N81-22761# Wisconsin Univ. - Madison. Mathematics Research Center.

REGULARIZING EFFECTS FOR U SUB t = DELTA(PSI(U))

Michael G. Crandall and Michel Pierre Jan. 1981 22 p refs
(Contract DAAG29-80-C-0041)
(AD-A096673; MRC-TSR-2166) Avail: NTIS HC A02/MF A01 CSCL 12/1

Nonlinear diffusion equations of the form u sub t = delta zeta (u) where zeta is a given nondecreasing function occur in many situations. Existence and uniqueness of solutions of the initial-value problem for this type of equation have been studied by many authors. The regularity of the solutions, i.e., how smooth or continuous they are, is less well understood, although many results have recently been obtained in this direction. In this paper, we contribute to the study of regularity by proving estimates of the general form zeta (u) sub t > or - c(zeta (u) + a)/t on nonnegative solutions in all of space. That is, one can bound below the time derivative of zeta(u) in a pointwise fashion by zeta (u) itself. Those results generalize those for the special case zeta(r) = r to the mth power obtained by Aronson and Benilan. GRA

N81-22762# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE EXISTENCE OF INFINITELY MANY SOLUTIONS OF THE DIRICHLET PROBLEM FOR SOME NONLINEAR ELLIPTIC EQUATIONS

Guang-Chang Dong and Shujie Li Dec. 1980 15 p refs
(Contract DAAG29-80-C-0041)
(AD-A096671; MRC-TSR-2161) Avail: NTIS HC A02/MF A01 CSCL 12/1

The existence of multiple solutions to nonlinear elliptic boundary value problems has been studied by many authors, especially when the nonlinear term is an odd function of the dependent variable. This paper shows, for a class of such equations, that when oddness is destroyed by adding a nonodd nonlinear perturbation to the equation, the resulting problem still possesses an infinite number of distinct solutions. GRA

N81-22763# Wisconsin Univ. - Madison. Mathematics Research Center.

A NEW PROOF AND AN EXTENSION OF A THEOREM OF

P. RABINOWITZ CONCERNING NONLINEAR WAVE EQUATIONS

K. C. Chang, Shujie Li, and G. C. Dong Dec. 1980 20 p refs
(Contract DAAG29-80-C-0041)
(AD-A096670; MRC-TSR-2158) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In 1978, P. Rabinowitz proved a theorem concerned with the existence of a nontrivial periodic solution of a nonlinear wave equation with a continuous increasing superlinear nonlinear term. In this paper we present a new and simpler proof of this theorem and relax an assumption on the nonlinear term, which is a discontinuous nondecreasing function. GRA

N81-22764# Wisconsin Univ. - Madison. Mathematics Research Center.

EIGENVALUE PROBLEMS ON INFINITE INTERVALS

Peter A. Markowich Dec. 1980 35 p refs
(AD-A096669; MRC-TSR-2157) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper is concerned with eigenvalue problems for boundary value problems of ordinary differential equations posed on an infinite interval. Problems of that kind occur for example in fluid mechanics when the stability of laminar flows is investigated. Characterizations of eigenvalues and spectral subspaces are given and the convergence of approximating problems which are derived by reducing the infinite interval to a finite but large one and by imposing additional boundary conditions at the far end is proved. Exponential convergence is shown for a large class of problems. GRA

N81-22765# Wisconsin Univ. - Madison. Mathematics Research Center.

THE INVERSE OF A TOTALLY POSITIVE BIINFINITE BAND MATRIX

Carl deBoor Dec. 1980 25 p refs
(Contract DAAG29-80-C-0041)
(AD-A096668; MRC-TSR-2155) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Spline approximation is often most effective when the breakpoint (knot) sequence can be chosen suitably non-uniform. At the same time, the standard approximation schemes (such as least-squares approximation, or interpolation at suitable interpolation points by splines) are so far only known to be usable and bounded as long as the breakpoint sequence is almost uniform. The problem of showing existence and uniqueness of bounded spline approximants to bounded data boils down to showing invertibility of a certain infinite matrix A. The distinguished features of this matrix are its bandedness and its total positivity, i.e., all minors of A are nonnegative. In this paper we show that if there is exactly one bounded sequence mapped by a biinfinite totally positive banded matrix A to the particular sequence (...,-1,1,-1,1,-1,...), then every bounded sequence is contained in the range of A. In spline terms, this result says, for example, that any bounded data sequence can be interpolated, and in exactly one way, with a bounded spline (with a given knot sequence, at a given interpolation point sequence) provided that the periodic data (+1,-1) can be interpolated, and in exactly one way, by a bounded spline from that class. Further, our arguments show that such an interpolating spline can be constructed as the limit of splines which satisfy finitely many of the given interpolation conditions. GRA

N81-22766# Wisconsin Univ. - Madison. Mathematics Research Center.

UNIFORM BASES OF EXPONENTIALS, NEUTRAL GROUPS, AND A TRANSFORM THEORY FOR H(M) (A,B)

David L. Russell Dec. 1980 79 p refs
(Contract DAAG29-80-C-0041)
(AD-A096666; MRC-TSR-2149) Avail: NTIS
HC A05/MF A01 CSCL 12/1

A theory relating the completeness and independence properties of sets of complex exponentials in the Sobolev spaces H to the m power (a,b) to strongly continuous groups of bounded operators on H to the m power (a,b) is presented. The generator is the differentiation operator on the domain /x epsilon H to the m+1 power (a,b) divides (x, eta) = 0/ where eta is an element of H to the m+1 power (a,b) prime whose Fourier transform has /lambda sub k as its zero set in the complex plane. In the process of proving the theorems, a new approach to the use of the Laplace transform in the spaces H to to the m power (a,b) is developed. J.D.H.

N81-22767# Wisconsin Univ. - Madison. Mathematics Research Center.

A THEORY FOR THE APPROXIMATION OF SOLUTIONS OF BOUNDARY VALUE PROBLEMS ON INFINITE INTERVALS

Peter A. Markowich Dec. 1980 49 p refs
(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)
(AD-A096663; MRC-TSR-2146) Avail: NTIS
HC A03/MF A01 CSCL 12/1

An ad hoc method to solve boundary value problems which are posed on infinite intervals is to reduce the infinite interval to a finite but large one and to impose additional boundary conditions at the far end. These boundary conditions should be posed in a way so that they express the asymptotic behavior of the actual solution well. In this paper a rigorous theory is derived which defines classes of appropriate additional boundary conditions. Appropriate is to be understood in the sense that the solutions of the approximate problems converge to the actual solution of the 'infinite' problem as the length of the finite interval tends to infinity. Moreover boundary conditions which produce convergence with the largest expectable order are devised. GRA

N81-22768# Wisconsin Univ. - Madison. Mathematics Research Center.

CRITICAL MANIFOLDS, TRAVELING WAVES AND AN EXAMPLE FROM POPULATION GENETICS

C. Conley Nov. 1980 42 p refs
(Contract DAAG29-80-C-0041; Grants NSF MCS-79-04443; NSF MCS-80-01816)
(AD-A096659; MRC-TSR-2142) Avail: NTIS
HC A03/MF A01 CSCL 12/1

A generalized Morse index theory is used to study the existence of travelling wave solutions of a diffusion-reaction system of equations. The reaction system is assumed to be 'close' to one which admits an attracting manifold of critical points. A scaling argument is used to see that the equations for travelling waves of the full system are then close to a system with a normally hyperbolic manifold of critical points. Standard perturbation theorems are already available to study the behavior of solutions of the 'perturbed' system which lie near the critical manifold in terms of a (derived) system of 'slow' equations on the manifold itself. Here, another such theorem, dealing with aspects of the system which can be described in terms of isolated invariant sets, is proved. Specifically, it states that isolated invariant sets of slow equations correspond to isolated invariant sets of the full system, and that the Morse index of the latter set is an n-fold suspension of that of the former where n is the number of unstable normal directions. GRA

N81-22769# Wisconsin Univ. - Madison. Mathematics Research Center.

LEAST-SQUARES SOLUTION OF LINEAR INEQUALITIES

S. P. Han Nov. 1980 23 p refs
(Contract DAAG29-80-C-0041; Grant NSF ENG-79-03881)
(AD-A096658; MRC-TSR-2141) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The paper deals with a system of linear inequalities in a finite dimensional space. When the system is inconsistent, we are interested in vectors that satisfy the system in a least-squares sense. We characterize such least-squares solutions and propose a method to find one of these solutions. It is shown that for any given system of linear inequalities and for any starting point, the method can produce a solution in a finite number of iterations. Computational results are very satisfactory in terms of accuracy and number of iterations. GRA

N81-22770# California Univ., Berkeley. Dept. of Mechanical Engineering.

AN INVARIANT INFINITESIMAL THEORY OF MOTIONS SUPERPOSED ON A GIVEN MOTION

J. Casey and P. M. Naghdi Aug. 1980 65 p refs
(Contract N00014-75-C-0148)
(AD-A096855; UCB/AM-80-6) Avail: NTIS
HC A04/MF A01 CSCL 12/1

The development of an infinitesimal theory of motion satisfying full invariance requirements and applying to any material undergoing finite deformation is described. The development is applicable to any material but special attention is given to elastic solids. An infinitesimal theory of elasticity with the following properties is included as a special case: (1) it is properly invariant under arbitrary, but not necessarily infinitesimal, superposed rigid body motions; (2) it reduces by specialization to the theory of rigid bodies undergoing finite motion; and (3) it can be brought into correspondence with the classical linear elasticity through a suitable reinterpretation of the symbols in the constitutive equation of the latter. J.D.H.

N81-22771# Wisconsin Univ. - Madison. Mathematics Research Center.

PERIODIC SOLUTIONS OF HAMILTONIAN SYSTEMS: A SURVEY

Paul H. Rabinowitz Dec. 1980 26 p refs Sponsored in part by Navy

(Contracts DAAG29-80-C-0041; N00014-76-C-0300)

(AD-A096642; MRC-TSR-2154) Avail: NTIS HC A03/MF A01 CSCL 12/1

Hamiltonian systems of ordinary differential equations model the motion of a discrete mechanical system. This paper surveys recent progress that has been made in establishing the existence of periodic solutions of such systems. GRA

N81-22772# Wisconsin Univ. - Madison. Mathematics Research Center.

BEHAVIOUR AT TIME t = 0 OF THE SOLUTIONS OF SEMI-LINEAR EVOLUTION EQUATIONS

R. Teman Dec. 1980 28 p refs

(Contract DAAG29-80-C-0041)

(AD-A096646; MRC-TSR-2162) Avail: NTIS HC A03/MF A01 CSCL 12/1

We investigate the regularity at time t = 0 of the solutions of linear and semi-linear evolution equations (including the Stokes and Navier-Stokes equations). Necessary and sufficient conditions on the data, for an arbitrary order of regularity are given (the classical 'compatibility conditions'). In the case of the Stokes and Navier-Stokes equations, the compatibility conditions which we find are global conditions on the data. The presentation given here seems to improve and generalize the known results even in the simplest case of linear evolution equations. Author (GRA)

N81-22773# Wisconsin Univ. - Madison. Mathematics Research Center.

SOME EXISTENCE THEOREMS FOR SEMILINEAR HYPERBOLIC SYSTEMS IN ONE SPACE VARIABLE

Luc C. Tartar Jan. 1981 32 p refs

(Contract DAAG29-80-C-0041)

(AD-A096648; MRC-TSR-2164) Avail: NTIS HC A03/MF A01 CSCL 12/1

We study semilinear hyperbolic systems with quadratic nonlinearities which originate in the kinetic theory of gas as a simplification of Boltzmann's equation. Local existence is well known for these equations and the main problem is to prove global existence for nonnegative bounded data. Except for the unrealistic case where a bounded invariant region exists, no result of this type is known in three space dimensions. As in all preceding results, based on the work of Mimura-Nishida and Crandall-Tartar, we restrict ourselves to one space dimension. We show global existence for a quite general class of systems and under some special condition (S) we obtain information on the asymptotic behavior and on scattering when the data have small L1 norm. The new idea lies in the introduction of some functional spaces where some products can be defined; this enables us to define an appropriate notion of solution in L1 and then use it to obtain local and global existence for data in L1 (R). GRA

N81-22774# Wisconsin Univ. - Madison.

MULTIGRID ALGORITHMS FOR THE SOLUTION OF LINEAR COMPLEMENTARITY PROBLEMS ARISING FROM FREE BOUNDARY PROBLEMS

Achi Brandt and Colin W. Cryer Oct. 1980 101 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-77-26732)

(AD-A096652; MRC-TSR-2131) Avail: NTIS HC A06/MF A01 CSCL 12/1

We show that the multigrid algorithms of Brandt can be adapted to solve linear complementarity problems arising from free boundary problems. The multigrid algorithms are significantly faster than previous algorithms. Using the multigrid algorithms, which are simple modifications of multigrid algorithms for equalities, it is possible to solve the difference equations to within truncation error using less work than the equivalent of six Gauss-Seidel sweeps on the finest grid. Author (GRA)

N81-22775# Wisconsin Univ. - Madison. Mathematics Research Center.

AN INHOMOGENEOUS QUASILINEAR HYPERBOLIC SYSTEM

Ching-hua Wang Nov. 1980 36 p refs

(Contract DAAG29-80-C-0041)

(AD-A096654; MRC-TSR-2137) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider guasilinear hyperbolic partial differential equations modeling ideal gas flow under various physical effects. When these effects are represented as Lipschitz continuous functions of the states, solutions to the initial value problem are shown to exist globally in time. Our analysis is based on the random choice method which generalizes the Glimm scheme for hyperbolic conservation laws. GRA

N81-22776# Wisconsin Univ. - Madison. Mathematics Research Center.

ANALYSIS OF BOUNDARY VALUE PROBLEMS ON INFINITE INTERVALS

Peter Markowich, A. Nov. 1980 55 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)

(AD-A096655; MRC-TSR-2138) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper boundary value problems on infinite intervals are treated. There is a theory for problems of this kind which requires the fundamental matrix of the system of differential equations to have certain decay properties near infinity. The aim of this paper is to establish a theory which holds under weaker and more realistic assumptions. The analysis for linear problems is done by determining the fundamental matrix of the system of differential equations asymptotically. For inhomogeneous problems a suitable particular solution having a 'nice' asymptotic behaviour is chosen and so global existence and uniqueness theorems are established in the linear case. The asymptotic behavior of this solution follows immediately. Non-linear problems are treated by using perturbation techniques meaning linearization near infinity and by using the methods for the linear case. Moreover, some practical problems from fluid dynamics and thermodynamics are dealt with and they illustrate the power of the asymptotic methods used. Author (GRA)

N81-22777# Wisconsin Univ. - Madison. Mathematics Research Center.

FINITE DIFFERENCE SCHEMES FOR CONSERVATION LAWS

Ronald J. DiPerna Nov. 1980 96 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-77-16049)

(AD-A096656; MRC-TSR-2139) Avail: NTIS HC A05/MF A01 CSCL 12/1

We study finite difference approximations to weak solutions of the Cauchy problem for hyperbolic systems of conservation laws in one space dimension. We establish stability in the total variation norm and convergence for a class of hybridized schemes which employ the random choice scheme together with perturbations of classical conservative schemes. We also establish partial stability results for classical conservative schemes. Our approach is based on an analysis of finite difference operators on local and global wave configurations. Author (GRA)

N81-22778# Wisconsin Univ. - Madison.

THE SINGULARLY PERTURBED TURNING POINT PROBLEM: A SPECTRAL APPROACH Mathematics Research Center.

Pieter deGroen (Vrije Univ., Brussels) Nov. 1980 29 p refs

(Contract DAAG29-80-C-0041)

(AD-A096657; MRC-TSR-2140) Avail: NTIS HC A03/MF A01 CSCL 12/1

Consider the two-point boundary value problem - epsilon u"

+ xu prime - lambda u = 0, u(-1) = A, u(1) = B, with 0 < epsilon < 1. For certain values of lambda, namely the eigenvalues, the problem need not have a solution; for epsilon > + 0 those eigenvalues tend to the non-negative integers. Although for values near such an eigenvalue the solution exists, it is very sensitive to small changes in lambda, and for a long time it has been unknown how to construct a rigorous asymptotic approximation to it. Yet an asymptotic approximation is of interest since the equation and its generalizations offer a deterministic model for the motion of a particle in a potential field, which executes a random walk under influence of small random forces. In this paper we construct asymptotic approximations to solutions of such problems, in which the coefficient of u prime has one or several zeros (turning points) and we prove their validity. GRA

N81-22779# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
OPTIMAL VALUE DIFFERENTIAL STABILITY BOUNDS UNDER THE MANGASARIAN-FROMOVITZ CONSTRAINT QUALIFICATION
Anthony V. Fiacco 1 Oct. 1980 45 p refs
(Contract DAAG29-79-C-0062)
(AD-A096760; SERIAL-T-435; ARO-16229.8-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

An implicit function theorem is applied to transform a general parametric mathematical program into a locally equivalent inequality constrained program, and upper and lower bounds on the optimal value function directional derivative limit quotient are shown to hold for this reduced program. These bounds are then shown to apply in programs having both inequality and equality constraints where a parameter may appear anywhere in the program. This paper draws on several preliminary results reported by Fiacco and Hutzler for the inequality constrained problem and provides a number of extensions and missing proofs. Author (GRA)

N81-22780# Oak Ridge National Lab., Tenn. Computer Sciences Div.
SOLVING QUADRATIC LAMBDA-MATRIX PROBLEMS WITHOUT FACTORIZATION
D. S. Scott and R. C. Ward Mar. 1981 26 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-76) Avail: NTIS HC A03/MF A01

An algorithm is presented for computing the eigenvalues of smallest magnitude and their associated eigenvectors of the quadratic lambda-matrix M lambda(2) + C lambda + K. M, C, and K are assumed to be symmetric matrices with K positive definite and M negative definite. The algorithm is based on a generalization of the Rayleigh quotient and the Lanczos method for computing eigenpairs of standard symmetric eigenproblems. Monotone quadratic convergence to the smallest positive and negative eigenvalue is proved. Test examples are presented. M.G.

N81-22781# Sandia Labs., Livermore, Calif.
EVALUATION OF A TEST SET FOR STIFF ODE SOLVERS
L. F. Shampine Jan. 1981 32 p refs
(Contract W-31-109-eng-38)
(SAND-80-2772) Avail: NTIS HC A03/MF A01

A set of problems for the testing of codes for stiff ordinary differential equation problems is evaluated. Changes are recommended that make the set a more useful tool. Comments about the difficulties of testing software in this area are made that lead to more thoughtful use of the test set. DOE

N81-22782# Centre National de la Recherche Scientifique, Marseilles (France).
POISSON PROCESSES ON GROUPS AND FEYNMAN PATH INTEGRALS
P. Combe (Centre de Physique Theorique), M. Sirugue (Centre de Physique Theorique), R. Hoegh-Krohn (Oslo Univ.), M. Sirugue-Collin (Provence Univ.), and R. Rodriguez (Centre de Physique Theorique) Sep. 1979 34 p refs
(CNRS-CPT-79-P-1139) Avail: NTIS HC A03/MF A01

An expression is given for the perturbed evolution of a free evolution (by gentle, possibly velocity dependent, potential) in terms of the expectation with respect to a Poisson process on a group. Various applications are given in particular to quantum mechanics but also to Fermi and spin systems. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-22783 Wisconsin Univ. - Madison.
AN ANALYSIS OF THE VOLUME-MATCHING PROBLEM AND RELATED TOPICS IN SMOOTH DENSITY ESTIMATION Ph.D. Thesis
Wing Hung Wong 1980 102 p
Avail: Univ. Microfilms Order No. 8102232

The problem of finding a nonnegative surface which minimizes the Dirichlet integral subjected to the volume matching constraints is investigated. An existence and uniqueness result is obtained for a general one sided interpolation problem which includes the volume-matching problem as a special case. A variational characterization is obtained via the generalized Kuhn Tucker theorem. Making use of regularity results in variational inequality, one can also obtain a characterization by local behavior and boundary conditions. Convergence of the piecewise linear finite element approximation is proved together with an order of magnitude estimate of the approximation error. In addition, criterion is suggested for the smoothing parameter of density estimates. The bootstrap method can be used to approximate the expected Kullback-Leibler information between the estimated and the true density. the criterion proposes choosing as the smoothing parameter the value which minimizes this approximated expected information distance. The empirically successful modified likelihood is seen to be related to the jackknife version of the bootstrap approximation to the expected information. Dissert. Abstr.

N81-22784 Wisconsin Univ. - Madison.
A STATISTICAL VIEW OF ACTUARIAL GRADUATION INCORPORATING A CORRELATED ERROR STRUCTURE Ph.D. Thesis
Stuart Lawrence Marks 1980 199 p
Avail: Univ. Microfilms Order No. 8102212

The statistical approach of the minimization of the variance of an estimate subject to a model is applied to graduation. A model for the correlation structure inherent in the ungraduated values is developed. This model is based on the assumption that the errors in the data form a stationary time series, creating correlations dependent only on the lag between observations. The moving weighted average method and the Whittaker-Henderson method are developed as minimum variance methods and shown to be applications of the method of least squares. It is then shown that the current popular applications of the two methods, i.e., the minimum-R sub z formulas and the Whittaker-Henderson Type A and Type B methods, are minimum variance methods only under specific assumptions concerning the autocorrelation structure of the ungraduated values. The maximimization of the discovery of information inherent in the data that can be used to better estimate the underlying values is emphasized. The information concentrated on is the correlation structure of the observations. If this is known or estimated, then use of this information will decrease the variance of the estimate under the model. Dissert. Abstr.

N81-22785 Wisconsin Univ. - Madison.
MULTIVARIATE TIME SERIES: SMOOTHING AND BACKWARD MODELS Ph.D. Thesis
William Robert Bell 1980 280 p
Avail: Univ. Microfilms Order No. 8105259

The signal plus noise decomposition, z sub t = s sub t + e sub t where z sub t is a kxl vector observable time series and s sub t and e sub t are the unobservable signal and noise components, is considered. The components s sub t and e sub t are assumed to be uncorrelated and e sub t is assumed to be white noise. What can be said given only the model for z sub t is investigated. It is shown that the set of sigma = Var(e sub t) admissible for the decomposition z sub t = s sub t + e sub t is a compact, convex set. Comparisons between univariate

smoothing of each series individually and multivariate smoothing of all series jointly are made in some simple cases. Methods for solving the maximization problem and computing the estimates of s sub t are discussed. Applications to some actual time series are presented. For nonstationary ARMA models a result is presented which verifies that the usual smoothing formula does indeed give the minimum mean squared error linear estimator of s sub t. Finally, backward multivariate ARMA models, which relate z sub t to its future, are considered. Dissert. Abstr.

N81-22786 Wisconsin Univ. - Madison.
BAYESIAN INFERENCE IN RANDOM COEFFICIENT LINEAR MODELS Ph.D. Thesis
William Gordon Fortney 1980 187 p
Avail: Univ. Microfilms Order No. 8102197

Two linear models in which the coefficients are assumed to be random are studied. The first is a multiple regression model in which the individual coefficients are normally distributed. The second is a multiple equation model in which the vectors of regression coefficients are multivariate normally distributed. Bayesian inferential methods are employed. Improper prior distributions for nuisance parameters of both models are suggested. For the first model a generalization permitting grouping of parameters is given and formulas for computing posterior distribution first and second moments, various kinds of modes, and marginal distributions are given. These formulas depend on a useful transformation of the random coefficients to canonical variables. Examples using artificial and real data are examined, including a study of a large data set consisting of measures of activity levels used to explain operating costs of U.S. life insurance firms. For the second (multiple equation) model, results of a computer Monte Carlo study to determine the performance of various types of modal estimates are presented. A reduction to canonical variables is discussed. Dissert. Abstr.

N81-22787 Wyoming Univ., Laramie.
THE DISTRIBUTION OF A CONSTRAINED REGRESSION ESTIMATOR Ph.D. Thesis
Ivan Raymond Thomas 1980 141 p
Avail: Univ. Microfilms Order No. 8106973

The density of an estimator of the parameter vector for the two and three parameter normal-error regression model is obtained. The estimator is a least squares estimator which is restricted to lie within a convex set defined by one or more linear inequalities. The restricted estimator is the unrestricted least squares estimator if the unrestricted estimator is interior to the convex set, or it is the orthogonal projection of that estimator onto the boundary of the set if the unrestricted estimator falls outside the set. The density consists of at least two subdensities. The restricted estimators interior to the set are distributed as a truncated bi- or trivariate normal. Those restricted estimators projected onto the boundary are distributed according to their location on the boundary which may be on faces, edges, or corners. The estimators projected onto a face are distributed as a scaled and truncated bivariate normal density; those projected onto an edge are distributed as a scaled and truncated univariate normal; and those projected onto a corner are distributed as a scaled degenerate density. A related test of the hypothesis that the parameter vector is an element of a half space defined by one linear inequality is also considered. Dissert. Abstr.

N81-22788 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE ASYMPTOTIC DISTRIBUTION OF THE CONVEX HULL OF A RANDOM SAMPLE Ph.D. Thesis
James Dowd Gale 1980 115 p
Avail: Univ. Microfilms Order No. 8107879

Three stationary stochastic processes, analogues of the three classical extreme value distributions, are derived as descriptions of the asymptotic behavior of the convex hull. A sample of n vectors in R(2) is considered from each of three classes of distributions which are invariant to rotations about the origin. Dissert. Abstr.

N81-22789 Florida State Univ., Tallahassee.
A MATHEMATICAL STUDY OF THE DIRICHLET PROCESS Ph.D. Thesis
Ram Chandra Tiwari 1981 160 p refs
Avail: Univ. Microfilms Order No. 8108190

The theory of Bayesian nonparametrics is addressed. A construction of the Dirichlet process on a finite set is introduced in such a way that it leads to the Blackwell's constructive definition of a Dirichlet process on a Borel space (x,A). If (x,A) is a Borel space and P is a random probability measure on (x,A) with a Dirichlet process prior D (alpha), then under the condition that the alpha measure of every open subset of x is positive, for almost every realization of P the set of discrete mass points of p is dense in x. A more general constructive definition is used to derive several properties of the Dirichlet process and to present in a unified way some of the known properties of the process. An alternative construction of Dalal's G invariant Dirichlet process (G being a finite group of transformations) is presented. Additional findings are addressed. Dissert. Abstr.

N81-22790 Georgia Univ., Athens.
THE USE OF MIXED WEIBULL DISTRIBUTIONS AS MODELS FOR GROWTH PROCESSES Ph.D. Thesis
Stephen Warwick Looney 1980 265 p
Avail: Univ. Microfilms Order No. 8107928

The use of the mixture of two three-parameter Weibull distributions as a possible model for a quantal response growth mechanism is proposed. The concept of availability is introduced and used to define the integrated Weibull distribution and then propose the use of the mixture of two three parameter integrated Weibull distributions as another possible model for the growth mechanism. Using techniques from bio-assay analysis, a procedure for fitting a mixture of either type of Weibull distribution to a set of observed quantal response data is developed. Approximate maximum likelihood estimates of the parameters of the growth model are obtained. Applications to reliability, bio-assay, and curve fitting problems are discussed. Finally, the computer implementation of the proposed procedure is described and a user's guide is included for reference. Indications of program limitations and CPU time required are provided. Dissert. Abstr.

N81-22791 Princeton Univ., N. J.
ROBUST ESTIMATION UNDER A FINITE NUMBER OF ALTERNATIVES: COMPROMISE ESTIMATES OF LOCATION Ph.D. Thesis
Roberta Guarino 1981 224 p
Avail: Univ. Microfilms Order No. 8108089

Optimal methods for estimating location when one is concerned with an estimator's performance at only a finite number of distributions. Four classes of compromise estimators are derived and then compared via a simulation. These classes are the psi compromised M estimators, the W compromised M estimators, and two classes of a type of estimator called a gap compromised estimator. Of the four classes, the psi estimators are the only ones which possess an exact optimality. All four classes of estimators turn out to be robust in the sense that each treats large observations in a way that is optimal for the longest tailed of the distributions being compromised. In the simulations, compromises are considered between the Gaussian and logistic distributions, between the Cauchy and Gaussian distributions, and between the slash and Gaussian distributions, with the most emphasis being placed on the last. The asymptotic properties of the psi compromised M estimators are also studied for a three distribution compromise and a method for choosing the third distribution when the first two are specified is given. Dissert. Abstr.

N81-22792 Princeton Univ., N. J.
THE BEHAVIOR OF THE T-TEST WHEN THE PARENT DISTRIBUTION IS LONG-TAILED Ph.D. Thesis
Yoav Benjamini 1981 114 p
Avail: Univ. Microfilms Order No. 8106912

An inequality is formulated: various criteria for comparing shapes of distributions are introduced and studied, leading to formulations of the notion of a distribution being long tailed with respect to another one. Using these criteria, together with a geometric interpretation of the t test formalized by use of majorization theory, it is proved that the t test is conservative but only for large enough critical values. For the less extreme values the t test might be liberal, and such counterexamples are given. The extent to which one has to go into the tails to be assured of the conservativeness, depends on the criterion used for comparing the shapes. Critical values greater than the

number of degrees of freedom are needed under the weakest criterion, and greater than 1.8 under the strongest one. The above results are applied to study the behavior of the t test under an asymmetric parent distribution. They are generalized to other t like statistics and their implications on some asymptotic results are discussed. Dissert. Abstr.

N81-22793 Tennessee Univ., Knoxville.
SAMPLE PATH PROPERTIES OF BANACH SPACE-VALUED STABLE STOCHASTIC PROCESSES Ph.D. Thesis
Donald Louie 1980 75 p
Avail: Univ. Microfilms Order No. 8108157

Results for Banach space valued general (not necessarily symmetric) stable stochastic processes are obtained. The results previously obtained by others are then unified and generalized in two directions: (1) the state space is an infinite dimensional Banach space and (2) no restrictive conditions (like symmetry) are placed on the stochastic processes. Dissert. Abstr.

N81-22794*# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.
CROSS-BISPECTRUM COMPUTATION AND VARIANCE ESTIMATION
K. S. Lii (California Univ., Riverside) and K. N. Helland [1981] 17 p refs
(Grant NsG-2376)
(NASA-CR-164219) Avail: NTIS HC A02/MF A01 CSCL 12A

A method for the estimation of cross-bispectra of discrete real time series is developed. The asymptotic variance properties of the bispectrum are reviewed, and a method for the direct estimation of bispectral variance is given. The symmetry properties are described which minimize the computations necessary to obtain a complete estimate of the cross-bispectrum in the right-half-plane. A procedure is given for computing the cross-bispectrum by subdividing the domain into rectangular averaging regions which help reduce the variance of the estimates and allow easy application of the symmetry relationships to minimize the computational effort. As an example of the procedure, the cross-bispectrum of a numerically generated, exponentially distributed time series is computed and compared with theory. Author

N81-22795# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
ON THE SAMPLE REDUNDANCY AND A TEST FOR EXPONENTIALITY
Mahesh Chandra, Tertius DeWet, and Nozer D. Singpurwalla 18 Jul. 1980 18 p refs
(Contracts N00014-77-C-0263; NRC-04-78-239)
(AD-A096956; SERIAL-T-424) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper we obtain the sampling properties of a scale-free estimator of 'redundancy,' an information theoretic measure, which is used by economists and communications engineers. We then propose a new test of exponentiality based upon the sample redundancy. This test is unbiased against a large class of alternatives, and it performs at least as well as another recently proposed test with respect to power and asymptotic relative efficiency. GRA

N81-22796# Air Force Systems Command, Washington, D.C.
SPLIT LEARNING CURVES
Allen Fatkin Oct. 1980 40 p
(AD-A097005; AFSC-CAIG-NR2) Avail: NTIS HC A03/MF A01 CSCL 12/1

The term 'learning curve' describes the improvement in efficiency of producing an item in quantities larger than one. Although the phenomenon has been known by other names and many different mathematical formulations on the learning curve have been developed, the basic concept is accepted throughout government and industry. Learning curve theory was developed from the observation that as more and more of the same item are produced, less time is spent on subsequent items. In a strict interpretation for a recurring production process, this theory would apply only to hands-on-labor. The theory has been developed and extended through the years to include cost improvements for recurring materials costs. In some cases rough analyses are made using only the total cost of an item when the detailed breakouts are not available. GRA

N81-22797# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
CONSISTENCY OF REGRESSION ESTIMATES WHEN SOME VARIABLES ARE SUBJECT TO ERROR Interim Report
Paul R. Gallo Feb. 1981 16 p refs
(Grant AF-AFOSR-0080-80; AF Proj. 2304)
(AD-A097008; MIMEO-SER-1097; AFOSR-81-0303TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For a general univariate 'errors-in-variables' model, the maximum likelihood estimate of the parameter vector (assuming normality of the errors), which has been described in the literature, can be expressed in an alternative form. In this form, the estimate is computationally simpler, and deeper investigation of its properties is facilitated. In particular, we demonstrate that, under conditions a good deal less restrictive than those which have been previously assumed, the estimate is weakly consistent. GRA

N81-22798# Stanford Univ., Calif. Dept. of Statistics.
UPDATING A DISCRIMINANT FUNCTION ON THE BASIS OF UNCLASSIFIED DATA
G. J. McLachlan and S. Ganesalingam Nov. 1980 27 p refs
(Contract N00014-75-C-0442)
(AD-A097030; SU-TR-47) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of updating a discriminant function on the basis of data of unknown origin is studied. There are observations of known origin from each of the underlying populations, and subsequently there is available a limited number of unclassified observations assumed to have been drawn from a mixture of the underlying populations. A sample discriminant function can be formed initially from the classified data. The question of whether the subsequent updating of this discriminant function on the basis of the unclassified data produces a reduction in the error rate of sufficient magnitude to warrant the computational effort is considered by carrying out a series of Monte Carlo experiments. The simulation results are contrasted with available asymptotic results. GRA

N81-22799# Stanford Univ., Calif. Dept. of Statistics.
A-OPTIMALITY FOR REGRESSION DESIGNS
N. N. Chan Jan. 1981 15 p refs
(Contract N00014-75-C-0442; Grant NSF MCS-78-07736; NR Proj. 042-034)
(AD-A097035; TR-49; TR-163) Avail: NTIS HC A02/MF A01 CSCL 12/1

Use is made of a result of Horn (1954) on the existence of a symmetric matrix prescribed diagonal elements and eigenvalues. A necessary and sufficient condition is then given for the existence of an A-optimal design for a regression experiment in the Dorogovcev (1971) setting. GRA

N81-22800# Stanford Univ., Calif. Dept. of Statistics.
GENERALIZED CORRELATIONS IN THE SINGULAR CASE
Ashis Sen Gupta Nov. 1980 13 p refs
(Contract N00014-75-C-0442; Grant NSF MCS-78-07736; NR Proj. 042-034)
(AD-A096958; TR-46; TR-161) Avail: NTIS HC A02/MF A01 CSCL 12/1

A general result is given which provides appropriate formulae for various generalizations of canonical correlations in the singular case. This covers as special cases the results for multiple correlation due to Tucker, Cooper and Meredith (1972) and Khatri (1976) and for partial and canonical correlations due to Rao (1979), (1980). The numbers of zero, unit and other critical generalized correlations are also given for the general case. GRA

N81-22801# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
TOPICS IN NONLINEAR FILTERING THEORY Ph.D. Thesis. Interim Technical Report
Daniel L. Ocone Dec. 1980 185 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A096973; LIDS-TH-1058; AFOSR-81-0232TR) Avail: NTIS HC A09/MF A01 CSCL 12/1

This thesis studies two topics in the theory of nonlinear filtering, the use of multiple stochastic integrals to analyze filters, and the use of Lie algebraic and operator-theoretic techniques to discover new, finite-dimensionally solvable filtering problems. The main results of the multiple integral techniques are: (1) a simplier and more insightful proof of a result of S. Marcus on filtering polynomials functions of a Gauss-Markov process, (2) a formula for representing the product of two multiple integrals as a sum of multiple integrals, thus providing a rudimentary calculus of multiple integral expansions, (3) an expansion of the optimal means square filter as a ratio of two multiple integral expansions, and (4) integral equations for the kernels of the best mean square filter of the class of (finite) r order multiple integral expansions. The problem of estimating a diffusion process observed in white noise is studied with Lie algebra techniques. Necessary conditions, and in the scalar case, necessary and sufficient conditions, are given for estimation algebra finite dimensionality. Examples of scalar problems with fin. dim. estimation algebras are discussed, and it is shown that, from among them, no new cases exist for which Zakai's equation can be solved by a Wei-Norman type method. GRA

N81-22802# Indiana Univ. at Bloomington. Dept. of Mathematics.

ON ESTIMATING INTER-SUBJECT VARIABILITY OF CHOICE PROBABILITIES UNDER OBSERVABILITY CONSTRAINTS Interim Technical Report

Robert Bartoszynski (Polish Academy of Sciences, Warsaw) and Madan L. Puri Feb. 1981 17 p refs

(Grants AF-AFOSR-2927-76; NSF MCS-76-00951; AF Proj. 2304)

(AD-A096977; AFOSR-81-0207TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper provides methods for estimating inter-subject variability of the probability of a given event defined in terms of subject's behavior (e.g., probability of a given choice in discrimination experiment). The constraints consist of using no more than two independent observations for each subject. Estimators are provided for assessing the inter-subject 'variance' of the analyzed probabilities. Also, a test variable is given for testing the hypothesis that the average probability is the same for two groups of subjects. GRA

N81-22803# Stanford Univ., Calif. Dept. of Statistics.

EXISTENCE OF MAXIMUM LIKELIHOOD ESTIMATORS OF AUTOREGRESSIVE AND MOVING AVERAGE MODELS

Theodore W. Anderson and Raul P. Mentz Oct. 1980 47 p refs

(Contract N00014-75-C-0442; NR Proj. 042-034)

(AD-A096995; TR-45) Avail: NTIS HC A03/MF A01 CSCL 12/1

There is given a sufficient condition on the observations from a scalar autoregressive process such that the maximum likelihood estimate exists and corresponds to a stationary process. A sufficient condition is given for the likelihood function to fail to have a maximum. In a moving average model the maximum likelihood estimates always exist. Some results are obtained for the autoregressive moving average model and vector models. It is shown that the solution to the sample Yule-Walker equations in the autoregressive case yield a stationary process. GRA

N81-22804# Stanford Univ., Calif. Dept. of Statistics.

EXACT DISTRIBUTIONS FOR GAPS AND STRETCHES

Joseph G. Deken 5 Jan. 1981 58 p refs

(Contract N00014-76-C-0475)

(AD-A097036; SU-TR-295) Avail: NTIS HC A04/MF A01 CSCL 12/1

Exact distributions for the largest gaps and stretches (higher order spacings) from points uniformly distributed on the unit interval are given, for up to ten points. General moment formulas and quantiles from these distributions, as well as the distributions themselves, are tabled, with approximate quantiles (obtained from an independent-beta approximation) for comparison. The results are derived via a recursive formulation, which is then implemented on the MACSYMA symbolic computation system. Moment generating functions derived by the same approach are also given. GRA

N81-22805# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.

LEAST SQUARES FITTING OF DISTRIBUTIONS USING NON-LINEAR REGRESSION Scientific Report, 1 Oct. 1979 - 30 Sep. 1980

Mark Heuser, Paul N. Somerville, and Steven J. Bean Hanscom AFB, Mass. AFGL 30 Sep. 1980 23 p refs

(Contracts F19628-80-C-0004; F19628-77-R-0120; AF Proj. 6607)

(AD-A097039; AFGL-TR-80-0362; SR-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report is concerned with techniques of estimating the parameter values of mathematical models. It begins with a brief discussion of mathematical models and how they relate to the physical situations they attempt to describe. Next, the method of least squares as it applies to both linear and nonlinear models is investigated. Special emphasis is given to nonlinear models with the linearization method. Finally, the report is concluded with an example from climatology. GRA

N81-22806# California Univ., Berkeley. Operations Research Center.

SCORING RULES AND THE INEVITABILITY OF PROBABILITY

Dennis V. Lindley Jan. 1981 27 p refs

(Contract N00014-75-C-0781)

(AD-A097045; ORC-81-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let a person express his uncertainty about an event E, conditional upon an event F, by a number x and let him be given, as a result, a score which depends on x and the truth or falsity of E when F is true. It is shown that if the scores are additive for different events and if the person chooses admissible values only, then there exists a known transform of the values x to values which are probabilities. In particular, it follows that values x derived by significance tests, confidence intervals or by the rules of fuzzy logic are inadmissible. Only probability is a sensible description of uncertainty. GRA

N81-22807# Naval Postgraduate School, Monterey, Calif.

STATISTICAL METHODS, SOME OLD, SOME NEW: A TUTORIAL SURVEY

Donald P. Gaver Jan. 1981 47 p refs Presented at the Summer School on Remote Sensing in Meteorol., Oceanog. and Hydrol., Dundee, Scotland, Sep. 1980

(NR Proj. 042-411; RR0140501)

(AD-A096680; NPS55GV-81-002) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report describes some new graphical and robust methods of statistical analysis. It also contains brief accounts of logistic (categorical) regression, and of regression in the presence of autocorrelated disturbances. GRA

N81-22808# Wisconsin Univ. - Madison. Mathematics Research Center.

AN APPLICATION OF THE GENERALIZED MORSE INDEX TO TRAVELLING WAVE SOLUTIONS OF A COMPETITIVE REACTION-DIFFUSION MODEL

C. Conley and R. Gardner Nov. 1980 43 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-80-1816)

(AD-A096661; MRC-TSR-2144) Avail: NTIS HC A03/MF A01 CSCL 12/1

The existence of travelling wave solutions of a diffusion reaction-system is studied via the generalized Morse index of isolated invariant sets. This index theory is analogous to degree theory, and the method of proof follows lines familiar from the latter theory. The equations in question are 'deformed' to a 'standard' system where the index can be easily computed, and the existence theorem follows from the 'non-triviality' of the index. The index theory has been described in other papers; here the main job is to construct 'isolating neighborhoods' which are analogous (in the degree theory) to open sets with no critical points on the boundary. Some novel means of location of such neighborhoods are described. GRA

N81-22809# Wisconsin Univ. - Madison. Mathematics Research Center.

A SEQUENTIAL K-GROUP RANDOM ALLOCATION

METHOD WITH APPLICATIONS TO SIMULATION
Andrew P. Soms Dec. 1980 14 p Sponsored in part by Navy
(Contracts DAAG29-80-C-0041; N00014-70-C-0321)
(AD-A096641; MRC-TSR-2153) Avail: NTIS HC A02/MF A01 CSCL 12/1

A sequential method of random allocation is given and it is shown how it can be used to estimate the observed significance levels of k-sample nonparametric tests. The sequential technique is compared to the standard random allocation technique and shown to be more efficient. An application is made to the Dunn-Bonferroni method of multiple comparisons. GRA

N81-22810# Wisconsin Univ. - Madison. Mathematics Research Center.
SAMPLING AND BAYES' INFERENCE IN SCIENTIFIC MODELING AND ROBUSTNESS
George E. P. Box Dec. 1980 47 p refs
(Contract DAAG29-80-C-0041)
(AD-A096645; MRC-TSR-2160) Avail: NTIS HC A03/MF A01 CSCL 12/1

Scientific learning is an iterative process employing criticism and estimation. Correspondingly the formulated model factors into two complimentary parts a predictive part allowing model criticism, and a Bayes posterior part allowing estimation. Implications for significance tests, the theory of precise measurement, and for ridge estimates are considered. Predictive checking functions for transformation, serial correlation, bad values, and their relation with Bayesian options are considered. Robustness is seen from a Bayesian viewpoint and examples are given. For the bad value problem a comparison with M estimators is made. GRA

N81-22811# Stanford Univ., Calif. Dept. of Statistics.
AN ADAPTIVE R-ESTIMATE
Michael Lee Cohen 15 Dec. 1980 67 p refs
(Contract DAAG29-79-C-0166)
(AD-A096768; SU-TR-5; ARO-16668.3-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

In 1962 Hajek proposed a test for location which was uniformly asymptotically fully efficient over a large class of distributions. Van Eeden subsequently derived the asymptotic theory for the corresponding R-estimate. Many authors have expressed reservations with regard to the small sample performance to be expected from this approach. In contrast to the methods of Hajek and Van Eeden, the procedure proposed here uses the entire data set to estimate the score function of the locally most powerful rank test. Using nearest neighbor density estimation methods, an estimate of the score function for the asymptotically most powerful grouped rank test is constructed. This function is itself a step function approximation to the score function for the locally most powerful rank test. Large sample distribution and optimality results are obtained for both the adaptive rank test and the corresponding R-estimate of location. Small sample Monte Carlo results are provided. GRA

N81-22812# Stanford Univ., Calif. Dept. of Statistics.
CONVERGENCE OF MOMENTS OF STANDARIZED QUANTILES
Keaven Anderson 15 Dec. 1980 11 p refs
(Contract DAAG29-79-C-0166)
(AD-A096780; SU-TR-4; ARO-16668.2-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

A sequence of independent identically distributed random variables is considered. Necessary and sufficient conditions on the density of the distribution are given for convergence of the moments of standardized quantiles of the first n observations as n to infinity. Similar conditions are given for the convergence of the moment generating function. GRA

N81-22813# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
SIEVES FOR NONPARAMETRIC ESTIMATION OF DENSITIES AND REGRESSIONS Interim Technical Report
Stuart Geman Jan. 1981 42 p
(Contract DAAG29-80-K-0006)
(AD-A096751; RPA-99; ARO-17444.1-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report is about the use of least-squares for nonparametric regression and the use of maximum likelihood for nonparametric density estimation. Typically, these classical techniques fail when applied to infinite dimensional problems. Grenander's method of sieves is a method for modifying classical estimators to make them appropriate for nonclassical problems. Examples are given here of the application of this method to the problems of regression and density estimation. GRA

N81-22814# Oak Ridge National Lab., Tenn. Mathematics and Statistics Research Dept.
APPLICATION OF THE POWER-SHIFT TRANSFORMATION WITH COMPUTING PROCEDURES
J. J. Beauchamp, V. E. Kane, and C. A. Serbin Mar. 1981 102 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-142) Avail: NTIS HC A06/MF A01

It is shown for the power-shift family of transformations that certain moments of the untransformed data do not exist, and the skewness of the untransformed data limits the range of the power parameter. Also, the likelihood function is shown to become infinite when the shift parameter is set equal to the negative of the minimum value of the observed data for the power parameter in the 0 to 1 interval. Thus, standard likelihood estimation is not feasible for the joint estimation of the power-shift parameters. An alternative weighted-order statistic estimator is explored. Marginal estimation of the power parameter as well as joint estimation is examined for the two estimation methods. Three example data sets are analyzed. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-22815 Arizona Univ., Tucson.
MULTIRATE INTEGRATION OF TWO-TIME-SCALE DYNAMIC SYSTEMS Ph.D. Thesis
William North Keepin 1980 276 p
Avail: Univ. Microfilms Order No. 8108326

Multirate integration of two-time-scale (TTS) initial value problems which are partitioned into fast and slow subsystems are studied. Multirate integration algorithms based on explicit Runge-Kutta (RK) methods are developed. Such algorithms require a means for communication between the subsystems. Internally embedded RK methods are introduced to aid in computing interpolated values of the slow variables, which are supplied to the fast subsystem. The use of averaging in the fast subsystem is discussed in connection with communication from the fast to the slow subsystem. Theoretical support for this is presented in a special case. A proof of convergence is given for a multirate algorithm based on Euler's method. Absolute stability of this algorithm is also discussed. Four multirate integration routines are presented. Two of these are based on a fixed-step fourth order RK method, and one is based on the variable step Runge-Kutta-Merson scheme. A nonlinear TTS model of an autopilot is presented. Dissert. Abstr.

N81-22816# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
DECISION SUPPORT WITH PARTIALLY IDENTIFIED PARAMETERS
Chelsea C. White, III, Andrew P. Sage, and William T. Scherer 15 Mar. 1981 51 p refs
(Contract N00014-80-C-0542; NR Proj. 197-065)
(AD-A096871; UVA/SE-81-5) Avail: NTIS HC A04/MF A01 CSCL 12/2

In this paper, we investigate the problem of determining a perference structure on the set of alternatives for a general class of single-stage, choice making models with imprecisely known parameters. A variety of decision making problems under certainty and under uncertainty are modeled by the general problem formulation. The imprecisely known parameters can be, for example, attribute trade-off weights, value scores, probabilities, and utility values. Parameter imprecision is described by assuming that certain groups of parameters are members of

given sets. This description forms the basis for a general and behaviorally relevant assessment model. Solution procedures for four important special cases of the general problem formulation are determined. A hypothetical automobile purchasing problem is used to illustrate the decision aiding applicability of the results. GRA

N81-22817# North Carolina Univ. at Chapel Hill. School of Business Administration.
REVISED (s,S) POWER APPROXIMATION
Charles Mosier, Harvey M. Wagner, and Richard Ehrhardt Feb. 1981 28 p refs
(Contract N00014-78-C-0467)
(AD-A096692; TR-18) Avail: NTIS HC A03/MF A01 CSCL 12/2

This investigation reformulates an approximately optimal algorithm for computing (s,S) inventory policies. The approximation is for a single-item periodic review model with set-up cost, linear holding and shortage cost, fixed replenishment lead time, and backlogging of unfilled demand. The analysis repeats the numerical analysis process performed to derive the Power Approximation - an approximately optimal (s,S) policy rule. The research reported here is a modification of the previous derivation to correct for both the non-homogeneity of the Power Approximation and the limiting behavior of the approximation for S-s. The operating characteristics of the modification are nearly as close to optimal as those of the original Power Approximation. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-22818 Vanderbilt Univ., Nashville, Tenn.
SEMIDISTRIBUTIVE LATTICE VARIETIES Ph.D. Thesis
Henry Rose 1980 78 p
Avail: Univ. Microfilms Order No. 8108289

Lattice varieties that satisfy the two semidistributive laws are examined. It is shown that there are eight infinite sequences of joint irreducible lattice varieties /L sub i(n)/(v) where i = 6, 7, 8, 9, 10, 13, 14, 15 and n=0,1,... Also, L sub i (0)=L sub i and /L sub i(n+1)/(v) is the unique join irreducible cover of the lattice varieties above. On the other hand, for i = 11 and for i = 12, the lattice form has at least two join irreducible covers. Subdirectly irreducible, semidistributive lattices that contain neither L sub 11 nor L sub 12 as a sublattice are studied in detail. It is shown, in particular, that every such lattice has a unique critical quotient c/a, and that the principal filter generated by a and the principal ideal generated by c are distributive. Dissert. Abstr.

N81-22819 Wisconsin Univ. - Madison.
ON LOGICS THAT EXPRESS THERE EXIST MANY INDISCERNIBLES Ph.D. Thesis
Charles Ira Steinhorn 1980 131 p
Avail: Univ. Microfilms Order No. 8105301

Logics with a generalized first-order quantifier that is to express there exist many indiscernibles are investigated. These quantifiers are intended to be possible mathematically precise renderings of the locution many similar x's. Unlike generalized first-order quantifiers, whose interpretations depend solely on set-theoretic notions, these quantifiers have language dependent interpretations. The quantifiers considered are various precise versions of there exist arbitrarily large finite sequences of indiscernibles, and there exists a k-powered sequence of indiscernibles for infinite cardinals k. It is shown that if k is a ramsey cardinal, then an abstract completeness theorem and an analogue of the Los ultraproduct theorem hold for the logic with the added quantifier there exists a k-powered sequence of L-indiscernibles. A simple characterization is given of a first-order theory being categorical in some infinite power, for a wide class of theories, in terms of logic with the quantifier there exists an infinite sequence of L-indiscernibles. An analogue of this result for the quantifier there exist arbitrarily large finite sequences of L-indiscernibles is also considered. Dissert. Abstr.

N81-22820 Wyoming Univ., Laramie.
SOME BOOLEAN PROPERTIES OF STONE LATTICES Ph.D. Thesis
Ben Andrew Budde 1980 81 p
Avail: Univ. Microfilms Order No. 8106961

Some properties of Boolean Algebras are studied in Stone Lattices. It is shown that the join infinite distributive (JID) and the meet infinite distributive (MID) properties do not necessarily hold in Stone Lattices. If the set of dense elements of the Stone Lattice is a chain, the JID and MID hold also, an example of a Stone Lattice is given in which JID and MID hold, but the dense elements do not form a chain. The stone space of a Stone Lattice is studied. A duality between continuous functions between stone spaces and homomorphisms between Stone Lattices is proved. Atoms are considered in Stone Lattices. A description of atom, atomic, and hereditarily atomic is given in terms of the triple characterization of Stone Lattices. It is proved that hereditarily atomic implies superatomic in Stone Lattices. The size of the free Stone Lattices with a finite number of generators is described in terms of the size of the free distributive lattices with 0 and 1 with a finite number of generators. Finally, the cardinal sequence of the free distributive lattices with 0 and 1 with a finite number of generators and the cardinal sequence of the free Stone Lattices with a finite number of generators are described. Dissert. Abstr.

N81-22821 Ohio State Univ., Columbus.
SOME PROBLEMS IN THE GEOMETRY OF BANACH SPACES Ph.D. Thesis
Pei-Kee Lin 1980 106 p
Avail: Univ. Microfilms Order No. 8107359

Four problems in the geometry of Banach spaces are considered. The first problem deals with best approximation. A theorem is proven which states that (L sub 1 + R) infinity has a Chebyshev subspace if and only if there exist two Chebyshev subspaces Y and Z such that Y is a hyperplane of Z. A similar theorem is proven when the real (L sub 1 + R) infinity is replaced by the complex (L sub 1 + C) infinity. The second problem deals with the geometric properties of unitary matrix spaces. The following two relations between E and C sub E are proved: (1) C sub E is p-convex (respectively p-concave) if E is p-convex (respectively, p-concave); (2) For $1 < or = P < or = 2$ (respectively, $p > or = 2$) if E is p-convex (respectively, p-concave), then C sub E satisfies an upper p-estimate (respectively, a lower p-estimate). The third problem deals with the geometric properties of interpolation spaces between two Banach spaces. Sufficient conditions for interpolation spaces to be super-reflexive are proved. The fourth problem deals with the geometric properties of the space of 2-summing operators. Dissert. Abstr.

N81-22822* California Univ., San Diego, La Jolla. Dept. of Mathematics.
ESTIMATING THREE-DEMENSIONAL ENERGY TRANSFER IN ISOTROPIC TURBULENCE Final Scientific Report, 1 Mar. 1979 - 30 Oct. 1980
K. S. Li, K. N. Helland (California Univ., Riverside), and M. Rosenblatt 30 Oct. 1980 69 p refs
(Grant NsG-2376)
(NASA-CR-164217) Avail: NTIS HC A04/MF A01 CSCL 12A

To obtain an estimate of the spectral transfer function that indicates the rate of decay of energy, an x-wire probe was set at a fixed position, and two single wire probes were set at a number of locations in the same plane perpendicular to the mean flow in the wind tunnel. The locations of the single wire probes are determined by pseudo-random numbers (Monte Carlo). Second order spectra and cross spectra are estimated. The assumption of isotropy relative to second order spectra is examined. Third order spectra are also estimated corresponding to the positions specified. A Monte Carlo Fourier transformation of the downstream bispectra corresponding to integration across the plane perpendicular to the flow is carried out assuming isotropy. Further integration is carried out over spherical energy shells. E.A.K.

N81-22823# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE CHOICE OF THE EXTERIOR KNOTS IN THE

B-SPLINE BASIS FOR A SPLINE SPACE Technical Summary Report
J. Kozak Dec. 1980 16 p refs Sponsored in part by Council for International Exchange of Scholars
(Contract DAAG29-80-C-0041)
(AD-A096665; MRC-TSR-2148) Avail: NTIS HC A02/MF A01 CSCL 12/1

The B-spline representation of a spline on some interval (a,b) requires the introduction of additional knots outside (a,b) that have nothing in common with the spline space itself. Nevertheless, their choice influences the numerical accuracy when the B-spline representation of a spline approximant is to be constructed. In this note we prove that locating all the additional knots at the endpoints a and b of the interval minimizes the norm and is therefore preferable. GRA

N81-22824# Indiana Univ. at Bloomington. Dept. of Mathematics.
THE HAUSDORFF ALPHA-DIMENSIONAL MEASURES OF THE LEVEL SETS AND THE GRAPH OF THE N-PARAMETER WIENER PROCESS Interim Technical Report
Madan L. Puri and Lanh Tat Tran Feb. 1981 16 p refs
(Contract AF-AFOSR-2927-76; AF Proj. 2304)
(AD-A096975; AFOSR-81-0204TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let W(N,d) be the N-parameter Wiener process with values in Rd. Then the dimension of the level sets is $N < d/2$ with positive probability if $d < 2N$. The dimension of the graph is a.s. min(2N, N + d/2). The level sets have zero (N - d/2) - measure a.s. and the graph has zero min(2N, N + d/2) - measure a.s. GRA

N81-22825# Florida State Univ., Tallahassee. Dept. of Statistics.
A THEOREM ON TREND-FREE BLOCK DESIGNS
Ching-Ming Yeh (Minnesota Univ., Morris) and Ralph A. Bradley Feb. 1981 14 p refs
(Contract N00014-80-C-0093)
(AD-A096575; FSU-STATISTICS-M569; TR-152-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An earlier, referenced report considered the existence of trend-free block designs and gave some general results for general block designs and some special results for complete block designs. This report presents a new existence theorem that is sufficiently general to cover broad classes of incomplete block designs and suggests a design construction method. Suppose that a common trend affecting treatment responses exists over the plots within blocks of a block design with usual design parameters, v,b,k,r. A trend-free block design, if it exists, is one for which treatments are assigned to plots within blocks so that treatment and block contrasts are orthogonal to specified trend components. We prove that, if a given block design is constructed and the common trend is linear, the necessary and sufficient condition for the existence of a trend-free block design with the same incidence matrix is that $1/2r(k+1)$ be an integer. GRA

N81-22826# Wisconsin Univ. - Madison. Mathematics Research Center.
INVERSES OF INFINITE SIGN REGULAR MATRICES
Carl deBoor, S. Friedland, and Allan Pinkus Dec. 1980 19 p refs
(Contract DAAG29-80-C-0041)
(AD-A096644; MRC-TSR-2159) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let A be an infinite sign regular (SR) matrix which can be viewed as a bounded linear operator from L sub infinity to itself. It is proved here that if the range of A contains the sequence (....1,-1,1,-1,...), then A is onto. If (inverse of A) exists then D (inverse of A) D is also SR, where D is the diagonal matrix with diagonal entries alternately 1 and -1. If case A is totally positive (TP), then D (inverse of A) D is also TP under additional assumptions on A. GRA

N81-22827# Wisconsin Univ. - Madison. Mathematics Research Center.
A FACTORIZATION OF TOTALLY POSITIVE BAND MATRICES
Carl deBoor and Allan Pinkus Dec. 1980 19 p refs
(Contract DAAG29-80-C-0041)
(AD-A096647; MRC-TSR-2163) Avail: NTIS HC A02/MF A01 CSCL 12/1

Every nonsingular totally positive m-banded matrix is shown to be the product of m totally positive one-banded matrices and, therefore, the limit of strictly m-banded matrices. This result is then extended to (bi) infinite 'nonsingular', totally positive matrices. In the process, such matrices are shown to possess at least one diagonal whose principal sections are all nonzero. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-22828 Georgia Inst. of Tech., Atlanta.
A BOUNDARY VALUE PROBLEM RELATED TO THE RADIATION OF SOUND FROM A SUPERSONIC JET Ph.D. Thesis
Richard Maurice Ingle 1980 103 p
Avail: Univ. Microfilms Order No. 8107285

A plane wave moving supersonically down a rigid cylindrical duct extended by means of a cylindrical vortex sheet is considered. The fluid in the region outside the extended jet is assumed to be still. A boundary value problem is used to model the acoustic pressure inside and outside the jet. Using various Fourier transforms, the problem is reduced to a functional equation of the Wiener-Hopf type. This functional equation is used as a basis to obtain information regarding the intensity of sound in the far field of the still fluid. It is shown that independent of the factorization applied, a certain modified Kutta condition is required at the edge of the pipe in order to obtain a consistent Wiener-Hopf solution to supersonic cylindrical jet problems of this type. The solution indicates that the instability wave associated with the vortex sheet remains a feature of the solution, even for Mach numbers, M, larger than 2 times the square root of 2. Dissert. Abstr.

N81-22829 Princeton Univ., N. J.
MODAL ANALYSIS OF INTERIOR NOISE FIELDS Ph.D. Thesis
Chen-Fu B. Chao 1981 218 p
Avail: Univ. Microfilms Order No. 8108086

A method and associated computer program were developed to compute the acoustic natural modes and natural frequencies of a cavity of arbitrary geometry. Simplified and efficient numerical techniques for solving the resulting algebraic equations are presented. The method has applicability to both two and three dimensional irregularly shaped cavities. Comparisons of present calculated results and other theoretical and experimental values show generally good agreement. The theoretical model was applied to predict the noise transmission through a single wall or a double wall/cavity system into a cavity. The reverberation process in a rectangular room for the low frequency range was also investigated. The room walls were covered with absorption material which is characterized by a normal incidence boundary condition or by Bliss' bulk reaction boundary condition. Results for modal reverberation time and overall reverberation time show considerable error may be introduced by treating a bulk-reacting liner as a point-reacting liner. Dissert. Abstr.

N81-22830 State Univ. of New York at Buffalo, Amherst.
AEROSOL AGGLOMERATION AND DEPOSITION IN

HIGH-INTENSITY ACOUSTIC FIELDS Ph.D. Thesis
Kiang-Hong Chou 1980 273 p
Avail: Univ. Microfilms Order No. 8104179

An investigation of acoustically induced turbulence and shock-waves in both standing-wave and traveling-wave tubes is performed under both stationary and flowing conditions. Acoustic intensity (I) and frequency (f) effects are studied using a constant-temperature anemometer and a fast Fourier transfer data processor. Sampled data are conditioned and processed to estimate the characteristics of turbulence. It is found that, regardless of the spatial locations in a standing-wave tube, turbulence appears at a sound pressure level larger than 160 dB. Furthermore, at a slightly higher level (approximately 162 dB) shock waves occur within a narrow band (+ or - 20 Hz) around the resonance frequencies. In a traveling-wave tube, turbulent bursts are noticed around I = 158 dB, and the shock waves appear at approximately I = 160 dB over the range of all frequencies. Dissert. Abstr.

N81-22831*# Boeing Commercial Airplane Co., Seattle, Wash.
INVESTIGATION OF THE EFFECTS OF INLET SHAPES ON FAN NOISE RADIATION Final Report
T. L. Clark, D. R. Slotboom, and P. G. Vaidya Washington NASA Apr. 1981 49 p refs
(Contract NAS1-15394)
(NASA-CR-3416) Avail: NTIS HC A03/MF A01 CSCL 20A

The effect of inlet shape on forward radiated fan tone noise directivities was investigated under experimentally simplified zero flow conditions. Simulated fan tone noise was radiated to the far field through various shaped zero flow inlets. Baseline data were collected for the simplest baffled and unbaffled straight pipe inlets. These data compared well with prediction. The more general inlet shapes tested were the conical, circular, and exponential surfaces of revolution and an asymmetric inlet achieved by cutting a straight pipe inlet at an acute angle. Approximate theories were developed for these general shapes and some comparisons with data are presented. The conical and exponential shapes produced directivities that differed considerably from the baseline data while the circular shape produced directivities similar to the baseline data. The asymmetric inlet produced asymmetric directivities with significant reductions over the straight pipe data for some angles. M.G.

N81-22832*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRFRAME NOISE OF A SMALL MODEL TRANSPORT AIRCRAFT AND SCALING EFFECTS
John G. Shearin May 1981 27 p refs
(NASA-TP-1858; L-14257) Avail: NTIS HC A03/MF A01 CSCL 20A

Airframe noise of a 0.01 scale model Boeing 747 wide-body transport was measured in the Langley Anechoic Noise Facility. The model geometry simulated the landing and cruise configurations. The model noise was found to be similar in noise characteristics to that possessed by a 0.03 scale model 747. The 0.01 scale model noise data scaled to within 3 dB of full scale data using the same scaling relationships as that used to scale the 0.03 scale model noise data. The model noise data are compared with full scale noise data, where the full scale data are calculated using the NASA aircraft noise prediction program. Author

N81-22833*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
THE ROLE OF COHERENT STRUCTURES IN THE GENERATION OF NOISE FOR SUBSONIC JETS Semiannual Report
G. L. Morrison 1 May 1981 24 p refs Original contains color illustrations
(Grant NAG1-112)
(NASA-CR-164214) Avail: NTIS HC A02/MF A01 CSCL 20A

Results from mean flow field surveys are reported. Flow fluctuation amplitude measurements and acoustic measurements are presented. The organized structure was characterized in terms of axial flow and radial flow. T.M.

N81-22834*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ACOUSTIC PROPERTIES OF TURBOFAN INLETS Semiannual Report, 1 Sep. 1980 - 28 Feb. 1981
Ben T. Zinn, Robert K. Sigman, and Scott J. Horowitz 28 Feb. 1981 9 p refs
(Grant NsG-3036)
(NASA-CR-164218) Avail: NTIS HC A02/MF A01 CSCL 20A

The finite element codes were improved using Hermitian elements and numerical integration of element relations. The question of real variable versus complex variable formulation was resolved and an integrated civil engineering system was implemented on the Georgia Tech Cyber 70/74. Efforts are underway to restructure the program to obtain the most efficient use of array storage. A.R.H.

N81-22835*# Kentron International, Inc., Hampton, Va.
AN OPERATIONS MANUAL FOR THE SPINNING MODE SYNTHESIZER IN THE LANGLEY AIRCRAFT NOISE REDUCTION LABORATORY
Daniel L. Palumbo Mar. 1981 50 p
(Contract NAS1-16000)
(NASA-CR-165698) Avail: NTIS HC A03/MF A01 CSCL 20A

The need for a dependable and controllable noise source and the consequent development of the Spinning Mode Synthesizer (SMS) is discussed. Configuration of the SMS incorporated into the flow duct facility is reported. Turbofan noise is composed of a series of fundamental acoustical modes, which are produced by acoustic drivers equispaced circumferentially around the flow duct. Pressure field is compared to an ideal result in an optimization algorithm, adjusting driver settings until system error is minimized. The following items are included: operating instructions, a detailed description of the system, and a user's guide to data acquisition packages available. E.A.K.

N81-22836*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EVALUATION OF A SIMPLIFIED NEAR FIELD NOISE MODEL FOR SUPERSONIC HELICAL TIP SPEED PROPELLERS
James H. Dittmar Mar. 1981 24 p refs
(NASA-TM-81727; E-768) Avail: NTIS HC A02/MF A01 CSCL 20A

Existing propeller noise models are versatile and complex but require large computational times, therefore a simplified noise model that could be used to obtain quick noise estimates for these propellers was evaluated. This simplified noise model compared favorably with a complex model for a straight blade propeller and for swept propeller blades when the propeller sweep was properly considered. The simplified model can thus be used as an approximation to the complex model. Comparisons of either the complex or simplified noise models with the available noise data are not good for supersonic propeller helical tip speeds. By adjusting various constants in the simplified model, the noise estimates can be brought into the same range as the data at the propeller design point but the variation of the model with helical tip Mach number remains different than the data. A.R.H.

N81-22837*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A THEORETICAL APPROACH TO SOUND PROPAGATION AND RADIATION FOR DUCTS WITH SUPPRESSORS
Edward J. Rice and David T. Sawdy (Boeing Military Airplane Co., Wichita, Kas.) 1981 44 p refs Proposed for presentation at the 101st Meeting of the ASA Ottawa, Ontario, 18-22 May 1981
(NASA-TM-82612; E-863) Avail: NTIS HC A03/MF A01 CSCL 20A

The several phenomena involved in theoretical prediction of the far-field sound radiation attenuation from an acoustically lined duct were studied. These include absorption by the suppressor, termination reflections, and far-field radiation. Extensive parametric studies show that the suppressor absorption performance can be correlated with mode cut-off ratio or angle of propagation. The other phenomena can be shown to depend explicitly upon mode cut-off ratio. A complete system can thus be generated

which can be used to evaluate aircraft sound suppressors and which can be related to the sound source through the cut-off ratio-acoustic power distribution. Although the method is most fully developed for inlet suppressors, several aft radiated noise phenomena are also discussed. This simplified suppressor design and evaluation method is summarized, the recent improvements in the technique are presented, and areas where further refinement is necessary are discussed. Noise suppressor data from engine experiments are compared with the theoretical calculations. A.R.H.

N81-22838*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE PROPELLER TIP VORTEX. A POSSIBLE CONTRIBUTOR TO AIRCRAFT CABIN NOISE
Brent A. Miller, James H. Dittmar, and Robert J. Jeracki Apr. 1981 11 p refs
(NASA-TM-81768; E-821) Avail: NTIS HC A02/MF A01 CSCL 20A

Although the assumption is generally made that cabin noise levels are governed by the transmission of propeller generated noise through the fuselage sidewall, it was postulated that the propeller wake striking the wing, in particular pressure disturbances generated downstream of the propeller by the action of the propeller tip vortex, could be strong enough to excite the aircraft structure and contribute to the cabin noise level. Tests conducted to measure the strength of the propeller tip vortex support this hypothesis. It was found that the propeller tip vortex can produce a fluctuation pressure on a simulated wing surface in the wake of a propeller that exceeds by more than 15 dB the maximum direct noise that would strike the fuselage. Wing surface response to propeller tip vortex induced excitations, and the effectiveness of this response in radiating noise to the cabin interior, must be established to assess the full significance of these results. A.R.H.

N81-22839*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF PREDICTED ENGINE CORE NOISE WITH PROPOSED FAA HELICOPTER NOISE CERTIFICATION REQUIREMENTS
U. vonGlahn and D. Groesbeck 1981 19 p refs Presented at the 101st Meeting of the ASA, Ottawa, Ontario, 18-22 May 1981
(NASA-TM-81739; E-791) Avail: NTIS HC A02/MF A01 CSCL 20A

Calculated engine core noise levels, based on NASA-Lewis prediction procedures, for five representative helicopter engines are compared with measured total helicopter noise levels and proposed FAA helicopter noise certification requirements. Comparisons are made for level flyover and approach procedures. The measured noise levels are generally significantly greater than those predicted for the core noise levels, except for Sikorsky S-61 and S-64 helicopters. However, the predicted engine core noise levels are generally at or within 3 db of the proposed FAA noise rules. Consequently, helicopter engine core noise can be a significant contributor to the overall helicopter noise signature and, at this time, will provide a limiting floor to a further decrease in future noise regulations. Author

N81-22840# New York Inst. of Tech., Dania, Fla.
IN SITU HEAT EXCHANGER TUBE FOULING THICKNESS MEASUREMENTS USING ULTRASONICS Final Report
Jules Hirshman and Robert S. C. Munier Sep. 1980 38 p refs Prepared in cooperation with Tracor Marine, Port Everglades, Fla.
(Contract W-31-109-eng-38)
(ANL/OTEC-BCM-014) Avail: NTIS HC A03/MF A01

The feasibility of establishing a practical microacoustic technique to measure fouling film thickness in situ on typical ocean thermal energy conversion (OTEC) heat exchanger tasks was studied. Seven techniques were studied for this application, including velocity measurements, acoustic diffraction, acoustic interferometer, Doppler flow velocity, pulse echo, critical angle, and surface (shear) wave effects. Of these, the latter five were laboratory tested using conventional microacoustic system components in various configurations. Only the pulse echo technique yielded promising results. On fouled aluminum plates, thin film layers of 40 microns and greater were measured using focused 30 MHz ceramic transducer operated at 25 MHz; this represents a resolution of about 2/3 wavelength. Measurements made on the inside of fouled 1 inch aluminum pipes yielded film thickness of 75 to 125 microns. The thinnest layer resolved was approximately 1-1/4 wavelength. The resolution of slime layer thickness in the magnitudes of OTEC interest (5 to 30 microns) using pulse echo microacoustics will require transducer development. DOE

N81-22841# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Abteilung Turbulenzforschung.
ACOUSTIC SIMILARITY LAW FOR CENTRIFUGAL FANS
Wolfgang Neise and Bernd Barsikow Aug. 1980 62 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-712)
(DFVLR-FB-80-36) Avail: NTIS HC A04/MF A01

Acoustic similarity laws for fans were exerimentally verified. Three, dimensionally similar centrifugal fans of 140, 280 and 560 mm impeller diameter were used. The fans were connected to anechoically terminated discharge ducts. It is shown that the influence of the Reynolds number on the radiated sound pressure is negligible within 140,000 < or = Reynolds number < or = 2,200,000 which is the range covered by the measurements. This result is in agreement with earlier studies in which the Reynolds number was varied from 14,000 to 450,000. Experimental results support the conclusion that fan noise data which is taken on model fans can be extrapolated to other dimensionally similar fans of different size for arbitrary fan speeds and working fluids, provided that the operating condition and the measurement position are the same. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-22842 Pennsylvania State Univ., University Park.
THE ROLE OF COLLISION COMPLEXES IN ION-MOLECULE REACTIONS Ph.D. Thesis
Robert Noel Abernathy 1980 217 p
Avail: Univ. Microfilms Order No. 8107530

An ion-beam-scattering-gas apparatus was used to investigate the reactions of several ions ($SiH3^+$ and $C3H5^+$) with ethylene. Collision complexes were proposed as intermediates in these reactions. A protonated cyclopropane structure was proposed for the methyl-ion-ethylene complex, while an ethylsilyl structure was proposed for the silyl-ion-ethylene complex. The role of collision complexes was shown to vary as a function of the energy for the silyl-ion-ethylene and the allyl-ion-ethylene systems. At relatively low ion energies (E<1 eV) the traditional collisional stabilization mechanism is invoked to explain to explain the pressure dependence of the detectable collision complexes. At the energies of this investigation (E>26 eV), the collisional stabilization mechanism cannot reasonably account for the initial increase in detectable complexes as a function of ethylene pressure. Dissert. Abstr.

N81-22843 Pennsylvania Univ., Philadelphia.
SPECTROSCOPY OF SOME MATRIX-ISOLATED HEAVY DIATOMIC MOLECULES OF GROUPS IVA, VA, AND VIA Ph.D. Thesis
Michael Allen Epting 1980 180 p
Avail: Univ. Microfilms Order No. 8107741

Absorption, emission, and resonance Raman spectra were investigated for the heavy atom diatomic molecules GeTe, Ns2, Sb2, and PbBi, all isolated in low temperature rare gas matrices. The matrices were prepared on surfaces held at 10 K by condensing about 10 millimoles of the desired rare gas with the vapor effluent from a heated Knudsen cell which contained the metallic sample. The resulting matrices had M/A ratios which ranged from 10,000 to 1,000,000. Both absorption and laser-induced emission spectra were recorded throughout the range from the ultraviolet to the near infrared regions. Additionally,

lifetime measurements were made for a number of the electronic transitions of these molecules. Dissert. Abstr.

N81-22844 Wisconsin Univ. - Madison.
CHARGED CURRENT NEUTRINO AND ANTINEUTRINO INTERACTIONS AND NUCLEON STRUCTURE FUNCTIONS Ph.D. Thesis
Stuart Maxwell Heagy 1980 236 p
Avail: Univ. Microfilms Order No. 8028182

Event distributions in the (Bjorken) scaling variables x and y are presented and interpreted in the framework of the quark parton model for 21578 neutrino and 7358 antineutrino events. Deviation from exact scaling is demonstrated in the energy dependence of the x- and y-distributions, as well as in a decrease of (sq Q)/E with increasing energy. The structure functions F(2) and xF(3) for an isoscalar target are calculated and studied as functions of x at fixed energy and as functions of sq Q at fixed x. Both F(2) and xF(3) increase at small x and decrease at large x as either the energy or sq Q increases. The changes in the structure functions, hence the distributions in the scaling variables x and y, are attributed to charm production from strange quarks in the sea and the inherent sq Q dependence of the structure functions as predicted by quantum chromodynamics. Tables of the structure functions are provided. In addition, momentum fraction distributions of the antiquarks are calculated by several methods and presented in various energy intervals.
Dissert. Abstr.

N81-22845 Arizona Univ., Tucson.
MODELS FOR INNER-SHELL EXCITATION IN ION-ATOM COLLISIONS Ph.D. Thesis
Shirley Jane Pfeifer 1980 124 p
Avail: Univ. Microfilms Order No. 8107442

The case of long-range coupling is considered. An analytic solution, derived with the adiabatic theory, shows explicitly the effect of translation factors on the ratio of vacancy production cross-sections of the high Z to low Z partners. The result reduces to that of the Demokov model in the low velocity limit. As the velocity increases, a sharing ratio which drops below the Demkov curve and reaches a maximum at finite velocity. Numerical calculations using translation factors in a molecular orbital basis exhibit such a fall-off which is due solely to the inclusion of the momentum transfer of the electron. A formulation of the problem which is not limited by the adiabatic assumptions was developed. This treatment offers new insights onto the competing effects taking place in the collision process as a function of velocity and, within the approximations made, describes the intermediate velocity region which cannot be treated by either the adiabatic or high velocity, perturbation theories. Dissert. Abstr.

N81-22846 Missouri Univ. -Rolla.
A MOLECULAR DYNAMICS STUDY OF THE STABILITY OF SMALL PRENUCLEATION WATER CLUSTERS Ph.D. Thesis
Tze-Shan Chen 1980 152 p
Avail: Univ. Microfilms Order No. 8108116

The dynamical stability and internal energy distribution of prenucleation water embryos were studied by the molecular dynamics method. Water clusters containing either five or twenty molecules were chosen to represent prenucleation embryos of small or intermediate size. A central force potential model of water which allows energy to be absorbed into intramolecular modes so that bond lengths and bond angles could adjust to changes in molecular environments was employed to describe the interaction between all pairs of atoms. The motion of the molecules was followed for extended time periods (of the order of several picoseconds) at each of a number of internal energies. Studies on the pentamers showed that below 90 K all isometric, locally stable structures persist for the entire duration of simulation without significant structural changes. Between 90 to 230 K structural interconversions took place. Above 230 K all isometric structures converted to a cyclic ring structure. As energy was further increased the structure also became unstable. Structure permutations, bond breaking and reforming occurred more and more frequently as energy was gradually added to the cluster. Finally, at around 300 K a molecule was evaporated from the cluster. Dissert. Abstr.

N81-22847 Ohio State Univ., Columbus.
MEASUREMENT OF COLLISION CROSS SECTIONS OF GASES WITH PHOTON ECHO TECHNIQUES Ph.D. Thesis
Tse Jeff Yang 1980 183 p
Avail: Univ. Microfilms Order No. 8107417

The theory for the production of photon echoes and the collision effects on the echo decay is developed and used to provide the method of measuring the total elastic collision cross section in gases. For the first time, it shows how the selection of time interval T between exciting pulses can distinguish between the small angle and large total cross sections. Dissert. Abstr.

N81-22848*# National Aeronautics and Space Administration, Washington, D. C.
RADIOACTIVE AND MAGNETIC INVESTIGATIONS
D. Heye and H. Beiersdorf Jul. 1979 14 p Transl. into ENGLISH from "Radioaktive und Magnetische Untersuchungen" p 716-725 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75508) Avail: NTIS HC A02/MF A01 CSCL 20K

Age and growth pattern determination of manganese nodules were explored. Two methods are discussed: (1) measurement of the presence of radioactive iodine isotopes; which is effective only up to 3.105 years, and (2) measurements of magnetism. The growth rates of three nodules were determined. The surface of the nodule was recent, and the overall age of the nodule could be determined with accuracy of better than 30%. Measurement of paleomagnetic effect was attempted to determine wider age ranges, however, the measured sign changes could not be interpreted as paleomagnetic reversals. E.A.K.

N81-22849# Varian Associates, Palo Alto, Calif.
FUNDAMENTAL RESEARCH OF MOLECULAR BEAM EPITAXY FOR DEVICE APPLICATIONS Final Report, 1 Oct. 1979 - 30 Sep. 1980
Y. G. Chai Nov. 1980 43 p refs
(Contract F49620-80-C-0011; AF Proj. 2305)
(AD-A096472; AFOSR-81-0157TR) Avail: NTIS HC A03/MF A01 CSCL 20/7

Characteristics of SnTe, Si, and Be were investigated as dopants in MBE of GaAs. SnTe exhibited substantially sharper doping profiles and lower surface segregations than elemental Sn. It appears that SnTe molecules incorporate mostly as Sn and Te pairs instead of independent Sn and Te atoms, and that this incorporation mechanism suppresses the surface segregation. It was also found that SnTe incorporation depends on the availability of Ga vacancies. The densities of Sn and Te and the SnTe-doped films were comparable, as expected from pair incorporation. The exact nature of the pair incorporation mechanism is not understood. It does not appear that SnTe incorporates as a molecule, since in that form it would give rise to a deep donor (25 meV-30 meV), which was not found in SnTe-doped films. DLTS measurements indicate that SnTe does not introduce detectable densities of deep traps in the film. Si was also studied in conjunction with accelerated growth rates. Si-doped films exhibited high mobilities and good photoluminescence (PL) characteristics. Lower energy peaks observed by others in liquid nitrogen temperature spectrum were not seen in our films, indicating these peaks are not inherently connected with Si doping. The accelerated growth rates did not affect the PL characteristics and only improved the liquid nitrogen mobilities. Be doping was studied in the range from 10 to the 16th power to 10 to the 19th power/cc. Satisfactory hole mobilities and p-n junctions were obtained, indicating adequate purity of the Be source. GRA

N81-22850# Varian Associates, Palo Alto, Calif. Solid State Lab.
SUBMICRON FETS USING MOLECULAR BEAM EPITAXY Annual Report, Aug. 1979 - Aug. 1980
S. Bandy, C. Nishimoto, Y. G. Chai, and V. Hoffman Jan. 1981 70 p refs
(Contract N00014-77-C-0655; RF62581001; NR Proj. 251-027)
(AD-A097026; AR-3) Avail: NTIS HC A04/MF A01 CSCL 20/7

Electron-beam exposure and MBE material have been used

to achieve quarter-micron gate length GaAs FETs. A noise figure of 1.2 dB with an associated gain of 13 dB has been measured at 8 GHz. GRA

N81-22851# Texas Univ. at Arlington. Dept. of Electrical Engineering.
NEW NONLINEAR OPTICAL PROCESSES IN MOLECULES AT INFRARED FREQUENCIES Annual Report, 30 Sep. 1979 - 31 Dec. 1980
Michael F. Becker 20 Feb. 1981 14 p refs
(Grant AF-AFOSR-3712-78; AF Proj. 2301)
(AD-A096957; AFOSR-81-0279TR; AR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

This second annual report details progress in the study of optical nonlinearities in molecules at infrared wavelengths. The objectives are to minimize the adverse effects of absorption in both triply resonant (1, 2, and 3 photon resonances) and two-photon resonant systems. A second objective is to examine molecules which have unusually strong and narrow Raman active modes at the two-photon resonance frequency. The experimental technique is to measure third harmonic generation in the molecular gas using a step tunable CO2 TEA laser. Results were obtained for CD4 at room temperature. The pressure, power, and frequency dependence of the third harmonic signal was measured. Problems were encountered as the fundamental absorption limited the ultimate conversion efficiency. Further experiments are proposed to be conducted at low temperatures which should alleviate this problem. GRA

N81-22852# Ohio Univ., Athens.
THEORY OF ELECTRON INDUCED REACTIONS Progress Report, 1 May 1980 - 30 Apr. 1981
D. S. Onley and L. E. Wright Feb. 1981 23 p refs
(Contract DE-AC02-79ER-10397)
(DOE/ER-10397/2) Avail: NTIS HC A02/MF A01

It was found that a model-independent correction to the spectrum could be defined for energies up to 200 MeV. It is shown, however, that drastically different current distributions for an M1 transition all share the same transition radius and produce the same correction to the M1 virtual spectrum. This insensitivity to details of the transition is evidently due to predominance of low-momentum-transfer components, which selects only comparatively low moments of the corresponding form factors. Simultaneous correction for finite size and Coulomb forces (finite charge) was studied, and an alarming interaction between the two corrections was found. Coulomb distortion effects in pair production were also calculated. The distortion factor, which is the ratio of the total pair production cross section with Coulomb distortion to the plane-wave result, is shown as a function of photon energy for Z = 92. Work was also done on pion electroproduction. DOE

N81-22853# Princeton Univ., N. J.
STUDIES OF MUON CAPTURE AND HYDROGEN TRANSFER MECHANISMS Progress Report, 1 Jan. - Dec. 1980
R. A. Naumann 1980 13 p refs
(Contract DE-AS02-76ER-02184)
(DOE/ER-02184/48) Avail: NTIS HC A02/MF A01

The thin walled (0.7 cm aluminum) gas cylinder apparatus successfully recorded mesic K X-ray spectra on contained gases. The year's activity concentrated on the capture of negative muons by solid solutions of the ionic salts and alloys and on the Coulomb capture of negative ions in nitrogen-oxygen gas mixtures with the gaseous binary compound nitric oxide. Practical applications of muon capture in nondestructive chemical analysis and in elemental or structural analysis for surface studies were discussed at a workshop. Work on the catalysis of fusion of hydrogen nuclei by the negative muon bonding is mentioned. A.R.H.

N81-22854# Wright State Univ., Dayton, Ohio.
DIRECT DETERMINATION OF ATOM AND RADICAL CONCENTRATIONS IN THERMAL REACTIONS OF HYDROCARBONS AND OTHER GASES Progress Report, 1 Jan. - 31 Dec. 1980
Gordon Kinner, Krishna M. Pamidimukkala, and David R. Wood Jan. 1981 9 p refs
(Contract DE-AS02-76ER-02944)
(COO-2944-5; ARP-5) Avail: NTIS HC A02/MF A01

Empirical calibrations for O atom concentrations were made, and correlated with O atom line shapes measured earlier. Measurements of O-atom concentrations were made in several H2-O2-Ar and D2-Ar mixtures, and rate constants of elementary reactions deduced from these measurements. A series of calculations of thermodynamic properties of CH3, C2D2, C2D4, C2H6 and C2D6, which were either unavailable or outdated, was made. A microcomputer system was installed to speed data acquisition and processing. DOE

N81-22855# Ohio State Univ., Columbus.
INTRODUCTION TO WEAK INTERACTION THEORIES WITH DYNAMICAL SYMMETRY BREAKING
K. D. Lane and M. E. Peskin (Commissariat a l'Energie Atomique, Saclay, France) Jul. 1980 48 p refs Lectures presented at the 15th Recontre de Moriond, France, Jul. 1980
(Contract DE-AC02-76ER-01545)
(DOE/ER-01545/276) Avail: NTIS HC A03/MF A01

A straightforward introduction to theories of the weak interactions with dynamical symmetry breaking-theories of technicolor or hypercolor is presented. The intent is to inform experimentalists, but also to goad theorists. The motivation for considering theories of this type is described. The structure that such a theory must possess, including new gauge interactions at mass scales of 1-100 TeV is then outlined. Despite their reliance on phenomena at such enormous energies, these theories contain new phenomena observable at currently accessible energies. Three such effects which are especially likely to be observed are described. DOE

N81-22856# California Univ., Los Angeles. Dept. of Physics.
SMALL ANGLE PROTON-PROTON AND PROTON-DEUTERON ELASTIC SCATTERING AT 800 MEV Thesis
Farokh Irom Jan. 1981 163 p refs
(Contract W-7405-eng-36)
(LA-8648-T) Avail: NTIS HC A08/MF A01

The energy of recoil particles was measured and used to obtain the following data at 800 MeV incident proton energy: the differential cross section for elastic proton-proton scattering at laboratory angles ranging between 1.340 and 6.450; the analyzing power for elastic proton-proton scattering at laboratory angles ranging between 2.80 and 6.450; and the differential cross sections and analyzing powers for elastic proton-deuteron scattering at laboratory angles ranging between 3.970 and 13.10. The data were analyzed to obtain information about the hadronic parts of the proton-proton and proton-neutron forward scattering amplitudes. The values were compared with the results of recent phase shift analyses and forward dispersion-relation calculation. DOE

N81-22857# Los Alamos Scientific Lab., N. Mex.
TWO-NEUTRON TRANSFER IN Pt AND Os NUCLEI AND THE IBA
J. A. Cizewski 1980 7 p refs Presented at the Conf. on Interacting Bosons in Nucl. Phys., Erice, Sicily, 12-19 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3475; CONF-8006127-3) Avail: NTIS HC A02/MF A01

The extracted relative enhancement factors in Pt were found to be in excellent agreement with the O(6) limit predictions. The differences in transfer strength between Pt and Os (t,p) could not be reproduced within the present framework of the interacting boson approximation model DOE

N81-22858# Los Alamos Scientific Lab., N. Mex. Thermal Sciences Div.
ON OPTIMIZING NONUNIFORM FINITE-DIFFERENCE GRIDS FOR BOUNDARY REGIONS IN TRANSIENT TRANSPORT PROBLEMS
D. R. Chenoweth and S. Paolucci Feb. 1981 71 p refs
(Contract DE-AC04-76DP-00789)
(SANDS-81-8204) Avail: NTIS HC A04/MF A01

Numerical solutions to a one dimensional transport problem, with constant diffusivity and Peclet number, are compared to the exact solution to verify the choice of nonuniform grid scheme and rezoning technique. The method chosen involves the use of the modified Roberts transformation with the transformed finite

difference approximations, and grid rezoning specified so that the error in boundary flux is controlled. Author

N81-22859# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT AND SPACE NUCLEAR SAFETY AND FUELS PROGRAM Progress Report
W. J. Maraman, comp. Sep. 1980 19 p
(LA-8714-PR) Avail: NTIS HC A02/MF A01

Results from investigations relating to the use of (238) PuO2 in radioisotopic power systems are reported. The development of general purpose heat sources and support systems are addressed. M.G.

N81-22860# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT AND SPACE NUCLEAR SAFETY AND FUELS PROGRAM Progress Report
W. J. Maraman, comp. Aug. 1980 31 p ref
(LA-8713-PR) Avail: NTIS HC A03/MF A01

Studies related to the use of 238PuO2 in radioisotopic power systems are detailed. The two programs involved are: general purpose heat source development and space nuclear safety and fuels. S.F.

N81-22861# Los Alamos Scientific Lab., N. Mex.
SPACE NUCLEAR POWER: A STRATEGY FOR TOMORROW
D. Buden and J. Angelo, Jr. 1981 12 p refs Presented at Am. Inst. of Aeron. and Astron. Conf. on Large Space Platforms, San Diego, Calif., 2 Feb. 1981
(Contract W-7405-eng-36)
(LA-UR-80-3592; CONF-810205-1) Avail: NTIS HC A02/MF A01

Space-based nuclear power, in turn, is a key technology for developing space platforms and the transportation systems necessary to service them. A strategy for meeting space power requirements is discussed. The development of a 100 kW(e) nuclear reactor system for high Earth orbit missions, transportation from shuttle orbits to geosynchronous orbit, and for outer planet exploration is described. It is concluded that as permanent settlements are established on the Moon and in space, multimegawatt power plants will be needed. This involves different technology which is similar to terrestrial nuclear power plants. DOE

N81-22862# Sandia Labs., Livermore, Calif.
PRELIMINARY EXPERIMENTS WITH A CUSP-FIELD ION SOURCE
Robert W. Bickes, Jr. and James B. OHagan Dec. 1980 25 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2696) Avail: NTIS HC A02/MF A01

Preliminary experiments with a cusp field ion source were completed and the total ion current and mass and energy distributions were measured as a function of source operating conditions and cusp field geometry. These experiments indicate that a cusp field source may be used in the Sandia neutron generator for cancer therapy and may permit the incorporation of a simplified unpumped accelerator design. Suggestions for future work are outlined. DOE

N81-22863# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
CHARACTERISTICS OF A SELF-EXTRACTION NEGATIVE ION SOURCE
K. W. Ehlers and K. N. Leung Oct. 1980 9 p refs Presented at the 2nd Intern. Symp. on the Production and Neutralization of Negative Ions and Beams, Upton, N.Y. 6-10 Oct. 1980; sponsored by Brookhaven National Lab.
(Contract W-7405-eng-48)
(LBL-11637; CONF-801068-18) Avail: NTIS HC A02/MF A01

A multi-cusp, self-extraction, negative hydrogen ion source was designed and constructed. Several diagnostic techniques were applied to study the operating characteristics of this type of source. Negative ions are produced on a negatively biased converter surface, and are self-extracted from the system. With the addition of cesium, the source operated at a neutral pressure of 1 x 10 to the -3 power. Toor to generate a steady-state H(-) ion current greater than 400 mA. The generation of impurity negative ions was investigated, as were methods for reducing the presence of background electrons in the ion region. Plans for a larger, next-generation device are discussed. DOE

N81-22864# California Univ., Berkeley. Accelerator and Fusion Research Div.
D(-) PRODUCTION BY CHARGE TRANSFER IN METAL VAPORS
A. S. Schlachter Oct. 1980 9 p refs Presented at the 2nd Intern. Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N.Y., 6-10 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11635; CONF-801068-17) Avail: NTIS HC A02/MF A01

Fast D(-) ions can be produced from D(+) by multiple charge transfer collisions in a metal vapor target. Experimental cross sections and thick target D(-) yields are presented and discussed. The high D(-) yield experimentally observed from charge transfer in cesium vapor is consistent with low energy cross section calculations and measurements. DOE

N81-22865# California Univ., Berkeley. Engineering and Technical Services Div.
PROGRESS IN COMPUTER-ASSISTED DIAGNOSIS AND CONTROL OF NEUTRAL BEAM LINES
E. Theil, V. Elischer, J. Fiddler, N. J. D. Jacobs, V. Jacobson, R. Lawhorn, D. Uber, and D. Wilner Sep. 1980 13 p refs Presented at the 11th Symp. on Fusion Technol., Oxford, England, 15-19 Sep. 1980
(Contract W-7405-eng-48)
(LBL-11839; CONF-800950-17) Avail: NTIS HC A02/MF A01

The principles that have guided the development of a computerized diagnostic and control system is discussed. The emphasis is on the general considerations which have influenced the design criteria for the system. Foremost among these are the requirements of an appropriate human interface to the system, and effective use of a relational data base. Examples are used to illustrate how these principles are carried out in practice. A systems view of diagnostic programs is suggested in the light of our experience. DOE

N81-22866# California Univ., Berkeley. Accelerator and Fusion Research Div.
H-ION FORMATION FROM A SURFACE CONVERSION TYPE ION SOURCE
K. N. Leung and K. W. Ehlers Oct. 1980 9 p refs Presented at the 2nd Intern. Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N.Y., 6-10 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11638; CONF-801068-19) Avail: NTIS HC A02/MF A01

Volume-produced H ions were extracted from a multicusp ion source by using a standard extraction system. In addition, a molybdenum converter is installed in the source to generate surface-produced H ions. The H ion yield is measured by a mass spectrometer. Without cesium, the production of H ions by the surface process is very small compared with those generated by volume production. However, the presence of cesium can greatly enhance the surface production yield. The energy spectrum shows that the surface generated H ions contain two distinct groups when cesium is added to the discharge. The energy of one group is essentially that of the sheath potential and appears to be produced by a desorption process. The second group of H ions have slightly higher energies and appear to be formed by a reflection process. Different types of converter materials were also tested. DOE

N81-22867# California Univ., Berkeley. Accelerator and Fusion Research Div.
COLLISIONS OF HIGHLY STRIPPED IONS AT MeV ENERGIES IN GAS TARGETS: CHARGE TRANSFER AND IONIZATION
A. S. Schlachter 1980 5 p refs Presented at the 6th Conf.

on the Appl. of Accelerators in Res. and Ind., Denton, Tex., 3-5 Nov. 1980
(Contract W-7405-eng-48)
(LBL-11779; CONF-810000-37) Avail: NTIS HC A02/MF A01

Cross sections were measured for charge transfer and ionization in H2 and rare-gas targets by fast, highly ionized carbon, iron, niobium, and lead ions in charge states +3 to +59, with energies in the range 0.1 to 4.8 MeV/amu. Experimental results are compared with classical-trajectory calculations; agreement is generally good. For a given target, the cross sections for net ionization reduce to a common curve when plotted as cross section divided by charge state versus energy per nucleon divided by charge state. DOE

N81-22868# Stanford Linear Accelerator Center, Calif.
STUDY OF LEADING STRANGE MESON RESONANCES AND SPIN-ORBIT SPLITTINGS IN K(-)p YIELDS K(-)PI(+)n AT 11 GeV/c
Alan Kern Honma Nov. 1980 254 p refs
(Contract DE-AC03-76SF-00515)
(SLAC-235) Avail: NTIS HC A12/MF A01

The results from a high statistics study of pi elastic scattering in the reaction K(-)p proceeds to K(-) pi(+)n are presented. By selecting the very forward produced K(-) pi(+) events, a sample consisting of data for the K pi proceeds to K pi elastic scattering reaction was extracted. The angular distribution for this meson-meson scattering is studied by use of both a spherical harmonic moments analysis and a partial-wave analysis (PWA). Evidence for spin 4 K resonance with a mass of 2080 MeV and a width of about 225 MeV is presented. The results from the PWA confirm the existence of a 0(+) kappa (1490) and propose the existence of a second scalar meson resonance, the 0(+) kappa' (1900). Structure in the P wave amplitude indicates resonance behavior in the mass region near 1700 MeV. In two of the four ambiguous solutions for the mass region above 1800 MeV, there is strong evidence for another P wave resonant structure near 2100 MeV. The observed strange meson resonances are found to have a natural interpretation in terms of states predicted by the quark model. DOE

N81-22869# State Univ. of New York, Albany. Dept. of Physics.
MEASUREMENT AND ANALYSIS OF NEUTRON CROSS SECTIONS WITH THE OAK RIDGE LINEAR ACCELERATOR NEUTRON FACILITY Progress Report, 1 Apr. 1980 - 31 Mar. 1980
J. B. Garg Nov. 1980 15 p refs
(Contracts DE-AS02-76ER-02439; EY-76-S-02-2439)
(COO-2439-7) Avail: NTIS HC A02/MF A01

High resolution neutron total and capture cross sections in the neutron energy range of few eV to a few hundred keV were measured, analyzed, and interpreted in many nuclei (Zn-64, Zn-66, Zn-67, Zn-68, Zn-70, Fe-57, Fe-58). An R matrix multilevel multichannel code was used for the total cross section and LSFIT code for the capture cross sections. The results of these analyses are reported. Some effort was also spent in modifying various computer programs of data transfer, and area and shape analysis of neutron total cross section data. Research results are sketched, and references are given to completed papers. DOE

N81-22870# Rice Univ., Houston, Tex.
NUCLEAR STRUCTURE AT INTERMEDIATE ENERGIES Progress Report, 1 Apr. 1980 - 31 Mar. 1981
G. C. Phillips and G. S. Mutchler 1981 44 p refs
(Contract DE-AC05-76ER-01316)
(DOE/ER-01316/204) Avail: NTIS HC A03/MF A01

The status of experiments investigating nuclear structure at intermediate energies is described. Pion nuclear scattering experiments, including the investigation of forward scattering amplitudes and reaction mechanisms, are described. The results of reactions, nonresonant pion production, spin dependencies, NN and pi D reduced widths at dibaryon resonances, reaction theory, and transverse spin-spin asymmetry, in two nuclear systems at medium energies are reported. Pion production and angular distribution experiments in three nucleon systems are described. J.D.H.

N81-22871# Centro Informazioni Studi Esperienze, Milan (Italy). Servizio Documentazione.
RADIOMETRIC METHODS FOR RADIOECOLOGICAL RESEARCH NEAR NUCLEAR PLANTS [METODI RADIOMETRICI PER INDAGINI RADIOECOLOGICHE INTORNO AD IMPIANTI NUCLEARI]
E. Bazzano and A. L. Traversi 1980 13 p refs In ITALIAN Presented at 3rd CNR Natl. Conv. on Attivitadi Ric. nei settori della Radiochim. e della Chim. Nucl., delle Radiazioni e de Radioelementi, Padua, 12-14 May 1980
(CISE-1615) Avail: NTIS HC A02/MF A01

Sampling methodology is emphasized. Sample size and method sensitivity are discussed. The methods include direct gamma spectrometry, gamma-gamma coincidence spectrometry, low background beta measurements, beta-gamma coincidence measurements, alpha emitters measurement and total dose measurement. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-22872# Naval Research Lab., Washington, D. C.
HIGH IMPEDANCE ION DIODE EXPERIMENT ON AURORA
R. A. Meger (JAYCOR, Alexandria, Va.), F. C. Young, A. T. Drobot (Science Applications, Inc., McLean, Va.), G. Cooperstein, Shyke A. Goldstein (JAYCOR, Alexandria, Va.), D. Mosher, S. E. Graybill (Harry Diamond Labs., Adelphi, Md.), G. A. Huttlin (Harry Diamond Labs., Adelphi, Md.), K. G. Kerris (Harry Diamond Labs., Adelphi, Md.), and A. G. Stewart (Harry Diamond Labs., Adelphi, Md.) 19 Mar. 1981 68 p refs
(AD-A096561; NRL-MR-4477) Avail: NTIS HC A04/MF A01 CSCL 20/8

An ion diode experiment has been performed on the Aurora accelerator. Average proton currents of approx. 50 kA at 5 MeV have been inferred from nuclear diagnostics. Computer simulations agree with the experimental results. GRA

N81-22873# General Atomic Co., San Diego, Calif.
TARGETS FOR HIGH POWER NEUTRAL BEAMS
Jinchoon Kim 1980 9 p refs Presented at the Conf. of the Appl. of Accelerators in Res. and Ind., Denton, Tex., 3-5 Nov. 1980
(Contract DE-AT03-76ET-51011; Gen. Atomic Proj. 3235)
(GA-A-16085) Avail: NTIS HC A02/MF A01

Stopping high power, long pulse beams, particularly in neutral beam injectors for heating magnetically confined plasmas is discussed. Neutral beam target technology is reviewed along with heat transfer calculations for some selected target designs. DOE

N81-22874# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN OF A MeV, 4kA LINEAR INDUCTION ACCELERATOR FOR FLASH RADIOGRAPHY
B. Kulke, R. Brier, W. Chapin, R. Kihara, R. Kuenning, B. McFarlane, G. North, K. North, S. Parkinson, D. Ravenscroft et al 10 Feb. 1981 21 p refs Presented at 1980 IEEE Intern. Conf. on Plasma Sci., Madison, Wis., 19-21 May 1980
(Contract W-7405-eng-48)
(UCID-18939) Avail: NTIS HC A02/MF A01

For verifying the hydrodynamics of nuclear weapons design, it is useful to have flash X-ray machines that can deliver a maximum dose in a minimum pulse length and with very high reliability. Such a requirement was identified some years ago as 500 roentgens at one meter, in a 60 nsec pulse length. In response to this requirement, a linear induction accelerator called FXR was designed. Using a cold cathode injector followed by 48 accelerator modules rated at 400 kV each, the FXR machine will accelerate a 4 Ka electron beam pulse to 20 MeV final energy. Key design features are the generation and the stable

transport of a low emittance (100 mr-cm) beam from a field emitter diode, the design of reliable, compact energy storage components such as Blumleins, feedlines and accelerator modules, and a computer-assisted control system. DOE

N81-22875# Los Alamos Scientific Lab., N. Mex.
SUITABILITY OF HIGH-CURRENT STANDING-WAVE LINAC TECHNOLOGY FOR ULTRARELATIVISTIC ELECTRON BEAM PROPAGATION EXPERIMENTS
David C. Moir, Rickey J. Faehl, Barry S. Newberger, and Lester E. Thode Jan. 1981 30 p refs
(LA-8645-MS) Avail: NTIS HC A03/MF A01

It is shown that near-term development of the existing PHERMEX (pulsed high energy radiographic machine emitting X-rays) standing wave linac would provide a 40-60 MeV electron beam with a current of 3 kA capable of answering a number of fundamental issues concerning endoatmospheric, ultrarelativistic electron beam propagation. Inherent high repetition rate and multiple pulse capability would allow alternative propagation scenarios to be investigated. M.G.

N81-22876# Los Alamos Scientific Lab., N. Mex.
OVERVIEW OF RESUSPENSION MODEL: APPLICATION TO LOW LEVEL WASTE MANAGEMENT
J. W. Healy 1980 12 p refs Presented at the Symp. on Modeling and Low-level Waste Management, Denver, 1-4 Dec. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3366; CONF-801217-1) Avail: NTIS HC A02/MF A01

The ways in which resuspension of radioactive or chemical wastes can occur are examined including wind resuspension, mechanical resuspension, and local resuspension. Methods of predicting exposure are also discussed. DOE

N81-22877# Argonne National Lab., Ill. Energy and Environment Systems Div.
PROBLEMS ASSOCIATED WITH SOLID WASTES FROM ENERGY SYSTEMS
S. Y. Chiu, L. Fradkin, S. Barisas, T. Surles, S. Morris (Brookhaven National Lab.), A. Crowther (Brookhaven National Lab.), and Vincent DeCarlo (DOE) Sep. 1980 177 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-118) Avail: NTIS HC A09/MF A01

Waste streams from many energy related technologies including oil coal, oil shale, tar sands, geothermal, oil and gas extraction, and nuclear power generation are reviewed with an emphasis on waste streams from coal and oil shale technologies. The available information on energy related solid wastes is outlined. Data on chemical composition and hazardous biological characteristics are included, supplemented by regulatory reviews and data on legally designated hazardous waste streams. Disposal and utilization options are provided with emphasis on solid waste disposal and recovery requirements specified under the RCRA. DOE

N81-22878# Sandia Labs., Livermore, Calif.
UNCERTAINTY ANALYSIS ASSOCIATED WITH RADIOACTIVE WASTE DISPOSAL: A DISCUSSION PAPER
R. M. Cranwell and Jon C. Helton (Arizona State Univ., Tempe) 1980 33 p refs Presented at DOE Statist. Symp., Berkeley, Calif., 29 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-2017C; CONF-801045-5) Avail: NTIS HC A03/MF A01

The uncertainty in the analysis of geologic waste disposal is discussed. The approach was to view uncertainty analysis in the context of the problem of how to convert from a deterministic model (i.e., a function whose input is a sequence of real numbers) to a probabilistic model (i.e., a function whose input is a sequence of random variables and whose output is one or more random variables). Uncertainty analysis is the study of how the properties of the output random variable are determined by the properties of the input random variables. Various questions which relate to uncertainty analysis for geologic waste disposal and the manner in which the problems associated with these questions are being treated in the Sandia project are considered. DOE

N81-22879# Oregon State Univ., Corvallis. School of Oceanography.
WHY CONSIDER SUBSEABED DISPOSAL OF HIGH LEVEL NUCLEAR WASTE
G. Ross Heath, Charles D. Hollister, D. Richard Anderson, and Margaret Leinen 1980 41 p refs Presented at the 2nd Intern. Ocean Disposal Symp., Woods Hole, Mass., 15 Apr. 1980 Prepared in cooperation with Woods Hole Oceanographic Inst., Sandia National Labs, Albuquerque and Rhode Island Univ., Narragansett
(Contract DE-AC04-76DP-00789)
(SAND-80-2346C; CONF-800420-5) Avail: NTIS HC A03/MF A01

Large areas of the deep seabed are assessed as potential disposal sites for high level radioactive waste because: (1) they are far from seismically and tectonically active lithospheric plate boundaries; (2) they are far from active volcanoes; (3) they contain thick layers of very uniform fine grained clays; (4) they are devoid of natural resources likely to be exploited in the forseeable future; (5) the geologic and oceanographic processes governing the deposition of sediments in such areas are remarkably insensitive to past oceanographic and climatic changes; and (6) sedimentary records of tens of millions of years of slow, uninterrupted deposition of fine grained clay support predictions of the future stability of such sites. Data accumulated to date on the permeability, ion retardation properties, and mechanical strength of pelagic clay sediments indicate that they can act as a primary barrier to the escape of buried nuclides. Environmental considerations as well as the legal, political and social issues raised by this concept are addressed. DOE

N81-22880# KMS Fusion, Inc., Ann Arbor, Mich.
VACUUM LAYER DOUBLE-SHELL CRYOGENIC INERTIAL FUSION TARGETS
R. J. Sims, D. L. Musinski, T. R. Pattinson, and R. B. Jacobs 1980 10 p refs Presented at the Am. Vacuum Soc. Conf., Detroit, 13 Oct. 1980 Prepared in cooperation with Jacobs (R. B.) Associates, Inc., Boulder, Colo.
(Contract DE-AC08-78DP-40030)
(KMSF-U-1007; CONF-801037-34) Avail: NTIS HC A02/MF A01

A double-shell cryogenic target was considered as a possible design for commercial Inertia Fusion (IF) reactors. Fabrication techniques were developed to the point where these targets were available for experimental evaluation. Heat transfer from the fuel container to the outer shell was obtained by a low pressure exchange gas between the two shells. The pressure and mass of gas was controlled by both temperature and the selection of the exchange gas. In the temperature range of interest (10 to 35 K) helium, a noncondensable gas, permitted a variation in both the pressure and the mass density within the gap between the shells. A thermal model was developed to evaluate the thermal characteristics of candidate target designs and estimate the fuel layer uniformity history of the target. DOE

N81-22881# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
WASTE MANAGEMENT PROGRAM Technical Progress Report, Apr. - Jun. 1980
Dec. 1980 170 p refs
(Contract DE-AC09-76SR-00001)
(DP-80-125-2) Avail: NTIS HC A08/MF A01

Information on operations and development programs for the management of radioactive wastes from operation of the Savannah River Plant is provided. The studies on environmental and safety assessments, waste from development and characterization, process and equipment development, on-site storage and disposal, the Defense Waste Processing, Facility, TRU waste, and low-level waste are reported in the Long-Term Waste Management Technology Program. The following studies are reported for the Interim Waste Operations Program: surveillance and maintenance, waste concentration, low-level effluent waste, waste tank evaluation, tank replacement/waste transfer, and solid waste storage. The development of criteria for the selection of sites for storage of waste forms produced in the Defense Waste Processing Facility is described in the Commercial Waste Program. DOE

N81-22882# Atomics International Div., Richland, Wash. Energy Systems Group.

RADIONUCLIDE RELEASE SCENARIO SELECTION PROCESS FOR A POSSIBLE REPOSITORY IN BASALT

R. C. Arnett, R. G. Baca, J. A. Caggiano, D. J. Carrell, and S. E. Logan Sep. 1980 16 p refs Presented at the Intern. Workshop on Radionuclide Scenarios for Geol. Repositories, Paris, 8-12 Sep. 1980 Prepared in cooperation with Los Alamos Scientific Lab.
(Contract DE-AC06-77RL-01030)
(RHO-BWI-SA-83; CONF-8009121-1) Avail: NTIS HC A02/MF A01

The feasibility of constructing a nuclear waste repository in a flow of the Columbia River Basalt Group located in the northwestern United States is assessed. Results of early efforts to develop a meaningful set of radionuclide release scenarios are given. The following topics are covered: generic release inducting phenomena; setting and characteristics of the Columbia River basalt; scenario selection criteria; preliminary scenario elimination; credible release scenario selection; and scenarios examined to date, which are interconnecting fault, magmatic dike or sill intrusion, shaft seal failure, borehole intrusion, and fracturing due to microearthquake swarms. DOE

N81-22883# Anacapa Sciences, Inc., Santa Barbara, Calif.

HUMAN FACTORS ANALYSIS AND DESIGN METHODS FOR NUCLEAR WASTE RETRIEVAL SYSTEMS: HUMAN FACTORS DESIGN METHODOLOGY AND INTEGRATION PLAN

S. M. Casey Jun. 1980 153 p refs
(Contract W-7405-eng-48)
(UCRL-15297-Vol-1) Avail: NTIS HC A08/MF A01

The nuclear waste retrieval system intended to be used for the removal of storage canisters (each canister containing a spent fuel rod assembly) located in an underground salt bed depository is discussed. The implementation of human factors engineering principles during the design and construction of the retrieval system facilities and equipment is reported. The methodology is structured around a basic system development effort involving preliminary development, equipment development, personnel subsystem development, and operational test and evaluation. Examples of application of the techniques in the analysis of human tasks, and equipment required in the removal of spent fuel canisters is provided. The framework for integrating human engineering with the rest of the system development effort is documented. DOE

N81-22884# Oak Ridge National Lab., Tenn. Physics Div.

BEAM SPECIE ANALYZER FOR INTENSE NEUTRAL BEAMS

C. F. Barnett and J. A. Ray Mar. 1981 20 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7656) Avail: NTIS HC A02/MF A01

A three channel neutral particle energy analyzer was fabricated and calibrated for H(0) particles. The H(0) beam with energies 3.5 to 55 keV was passed through a N2 gas cell maintained at charge equilibrium pressures. Positive hydrogen ions formed by stripping collisions were energy analyzed by a 45 deg, parabolic, electrostatic analyzer and detected by three Faraday cups spaced to intercept the full, half, and third energy beam components. The conversion efficiency of the analyzer system increased from 0.11 at 3.5 keV to 0.54 at 55 keV with an accuracy of plus or minus 3 percent. DOE

N81-22885# California Univ., Berkeley. Accelerator and Fusion Research Div.

DEDICATED HEAVY ION MEDICAL ACCELERATORS

R. A. Gough 1980 24 p refs Presented at the MARIA Workshop on Accelerator Systems for Relativistic Heavy Ions in Med. and Sci. Res., Edmonton, Canada, 20-24 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11808; CONF-8010115-3) Avail: NTIS HC A02/MF A01

Technological considerations in the design of accelerator facilities for medical applications are outlined. Emphasis is placed on the specific requirements for MARIA, a radioisotope and radiotherapy facility currently under development. Requirements for the control system and considerations of facility layouts are also discussed. DOE

N81-22886# California Univ., Berkeley. Accelerator and Fusion Research Div.

LARGE-APERTURE D(-) ACCELERATORS

O. A. Anderson 1980 7 p refs Presented at the Brookhaven Natl. Lab. 2nd Intern. Symp. on the Production and Neutralization of Negative Ions and Beams, Upton, N.Y., 6-10 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11824; CONF-801068-22) Avail: NTIS HC A02/MF A01

Accelerator designs are described for D(-) produced by double charge exchange, by the ion magnetron, and by the Lawrence Berkeley Lab bucket source; in all three cases the accelerators employ a single slot per module. High and low energy designs are discussed; in the latter cases the perveances are much larger than in typical D(+) accelerators. DOE

N81-22887# Rice Univ., Houston, Tex. Nuclear Labs.

HIGH ENERGY PHYSICS Progress Report, 1 Mar. 1980 28 Feb. 1981

G. C. Phillips and J. B. Roberts 1981 39 p refs
(DOE/ER-05096/8) Avail: NTIS HC A03/MF A01

The status of high energy physics experiments on spin dependence of the nucleon-nucleon interaction is reported. Data from experiments on measurement of the spin parameters A and A sub nn in n-p and p-p elastic scattering, energy dependence of A sub nn in p-p elastic scattering, and measurements of the delta sigma sub T in p-p and p-d scattering are analyzed. The status of investigations of energy dependence using polarized proton beams, the polarized beam acceleration project, and on the higher energy polarization studies is reported. J.D.H.

N81-22888# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

A STUDY ON POSTDRYOUT HEAT TRANSFER FOR CONDITIONS OF INTEREST IN LOSS OF COOLANT ACCIDENT ANALYSIS

G. Barzoni 1980 31 p refs Presented at CSNI Specialist Meeting on Safety Aspects of Fuel Behavior in Off-Normal and Accident Conditions, Espoo, Finland, 1-4 Sep. 1980 Sponsored by NUCLITAL
(CISE-1616) Avail: NTIS HC A03/MF A01

A method to predict heat transfer coefficients in dispersed flow postdryout conditions is discussed. It consists of a theoretical model for actual quality calculation and of a correlation to calculate convection coefficients. Actual quality is expressed as a function of dryout quality, distance from dryout, heat flux, mass flux, tube diameter and fluid properties. To check the method postdryout heat transfer data were obtained at pressures of 30, 50, and 70 bars and mass fluxes of 125, 500, and 1000 kg/sq m/sec, using a special tubular test section. Comparisons among experimental heat transfer coefficients, predictions by the present method, and by some other available methods are reported.
Author (ESA)

N81-22889# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

AN ANALYTICAL MULTIGROUP COARSE-MESH METHOD WHICH RIGOROUSLY DETERMINES THE CORE LOCAL FLUX

G. M. Bottoni and A. Bassini 1980 15 p refs Presented at 1980 Advan. in Reactor Phys. and Shielding Meeting, Sun Valley, Idaho, 14-17 Sep. 1980 Sponsored by Ente Nazionale per l'Energia Eletricca
(CISE-1632) Avail: NTIS HC A02/MF A01

Both the node averaged fluxes and the local fluxes inside the node, usually determined separately in coarse-mesh methods, are obtained on the basis of only one scheme. This approach links together the advantages of an increased logical accuracy with those of a decreased computational complexity. Owing to the arbitrariness in the choice of the trial functions, the method may be easily modified to take into account any suggestion that may arise in the future from practical applications.
Author (ESA)

74 OPTICS

Includes light phenomena.

N81-22890 Arizona Univ., Tucson.
LIGHT SCATTERING FROM REFLECTING OPTICAL SURFACES Ph.D. Thesis
David Alan Thomas 1980 269 p
Avail: Univ. Microfilms Order No. 8108322

The particle contaminant contribution to the scattering of visible light from front surface mirrors was studied. Scattered light distributions are also recorded and discussed for several diffuse reflectors. The operation and limitations of a device used to measure the angular distribution of light scattered from nominally flat, reflecting optical surfaces are described. The scattering levels of most of the mirrors are shown in good agreement with their photographically recorded degree of particulate contamination. The polarization state of light scattered from both smooth and rough reflecting surfaces is determined experimentally and discussed. Results obtained for the smooth samples are shown to be qualitatively explained by a simple model for scattering from surface particulates. Invariance properties are also empirically determined for the scattered light profiles of several samples. Dissert. Abstr.

N81-22891 Arizona Univ., Tucson.
ABERRATION FIELDS IN TILTED AND DECENTERED OPTICAL SYSTEMS Ph.D. Thesis
Kevin Paul Thompson 1980 292 p
Avail: Univ. Microfilms Order No. 8106927

A formulation of the wave aberration expansion was developed that accounts for the effects of tilts and decenters in the context of the aberration fields in an aligned system. Techniques for displaying the properties of the third and fifth order terms in the wave aberration expansion in a perturbed system were developed. The methods of display allow a designer who is well acquainted with the behavior of the terms in a rotationally symmetric system to envision their behavior in a perturbed system without being well acquainted with the theory that is developed. Dissert. Abstr.

N81-22892 Arizona Univ., Tucson.
INTERFEROMETRIC MEASUREMENT OF DISPERSION IN OPTICAL FIBERS Ph.D. Thesis
William Dean Bomberger 1980 80 p
Avail: Univ. Microfilms Order No. 8106928

The experiments were performed using a multimode GaAlAs semiconductor laser to measure the total dispersion of a borosilicate single mode optical fiber at a wavelength of approximately .873 micro m. The experiments were conducted using various combinations of laser spectral width and fiber length. Changing the drive current to the laser enabled its spectral width to be varied from 2.3 nm to 5.8 nm FWHM. The fiber length was varied from approximately 0.2 m to 1.0 m. An analysis was also carried out to explain the effects on the interferograms of the unequal mode spacing of the multimode GaAlAs laser. Two methods of approximating the amount of variation of the laser mode spacing were also developed based on analysis of the interferograms. Analysis of the autocorrelation interferogram allowed the GaAlAs laser spectral width to be determined. Dissert. Abstr.

N81-22893 Drexel Univ., Philadelphia, Pa.
TWO-PHOTON RESONANT, OPTICAL THIRD-HARMONIC GENERATION Ph.D. Thesis
Edward John Seibert 1981 108 p
Avail: Univ. Microfilms Order No. 8107073

A theory was developed for two photon resonant, optical third harmonic generation that treats the atomic medium dynamically. The macroscopic polarization induced in the medium by the fundamental field is shown to contain components that oscillate at both the fundamental and third harmonic frequencies. The polarization acts as source term in a set of coupled transport equations for the field amplitudes and phases. The third harmonic of 8853 angstroms was detected using cesium as the atomic medium. A ruby pumped infrared organic dye laser was developed to produce the fundamental field needed for the process. The low yield of the observed third harmonic signal is attributable to the incomplete phase matching in the medium and to collisional quenching of the excited state population due to high buffer gas pressures. Dissert. Abstr.

N81-22894*# National Aeronautics and Space Administration. Pasadena Office, Calif.
FOCAL PLANE ARRAY OPTICAL PROXIMITY SENSOR Patent Application
Alan R. Johnston, inventor (to NASA) (JPL, California Inst. of Technology., Pasadena) Filed 11 Mar. 1981 18 p
(Contract NAS7-100)
(NASA-Case-NPO-15155-1; US-Patent-Appl-SN-242797) Avail: NTIS HC A02/MF A01 CSCL 20F

An optical proximity sensor with an illuminator assembly which includes an illuminator lens and a plurality of light emitting diodes located at first predetermined positions along the focal plane of the illuminator is lens is presented. A detector assembly including a detector lens and a plurality of photodiodes located at second predetermined positions along the focal plane of the detector lens is also provided. The two lenses are spaced apart in accordance with the configuration of the light emitting diodes and the photodiodes to define a predetermined detection volume. Each light emitting diode has a corresponding photodiode, and their relative positions on their respective focal planes determine the detection volume defined by their overlapping fields of view. NASA

N81-22895*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE PINHOLE/OCCULTER FACILITY
H. S. Hudson (California Univ., San Diego), J. L. Kohl (Harvard-Smithsonian Center for Astrophysics), R. P. Lin (California Univ., Berkeley), R. M. MacQueen (National Center for Atmospheric Research), E. Tandberg-Hanssen, and J. R. Pabbs Mar. 1981 32 p refs
(NASA-TM-82413) Avail: NTIS HC A03/MF A01 CSCL 20F

A large occulting system in space can be used for high resolution X-ray observations and for large aperture coronagraphic observations in visible and UV light. The X-ray observations can combine high angular resolution in hand (>10 keV) X-radiation with the high sensitivity of a multiple pinhole camera, and can permit sensitive observations of bremsstrahlung from nonthermal particles in the corona. The large aperture coronagraphs have two major advantages: high angular resolution and good photon collection. This will permit observations of small scale structures in the corona for the first time and will give sufficient counting rates above the coronal background rates for sensitive diagnostic analysis of intensities and line profiles for coronal structures in the solar wind acceleration region. The technical basis for performing observations with a large occulting system in these three wavelength ranges is described as well as a pinhole/occulter facility presently being considered for Spacelab. Some indications about future developments are included. A.R.H.

N81-22896# Honeywell Corporate Technology Center, Bloomington, Minn.
NONLINEAR OPTICAL PHENOMEMA IN SOLIDS Final Report, 1 Jan. 1977 - 31 Dec. 1980
Paul W. Kruse, John F. Ready, Muhammad A. Khan, T. N. Casselman, and T. J. Moravec Feb. 1981 31 p refs
(Contract F49620-77-C-0028; AF Proj. 2306)
(AD-A096978; AFOSR-81-0252TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

Three nonlinear optical effects in (Hg,Cd)Te have been experimentally evaluated, including the spin-flip Raman laser, four-photon mixing, and optical phase conjugation. Theoretical analysis has revealed the role that Auger recombination plays in limiting the lifetime in p-type (Hg,Cd)Te and strongly degenerate n-type (HgCd)Te. Diamondlike carbon thin films have been produced by argon sputtering in the presence of hydrocarbon gas. Ten major new discoveries have been documented. One patent disclosure was filed and one is in preparation. Ten scientific papers have been published, two chapters are in press and two papers have been accepted for publication. Twenty-three spoken papers have been presented at scientific meetings and four have been submitted for presentation. Twenty-six major interactions

with other scientists and organizations have occurred. Samples of (Hg,Cd)Te have been supplied to six universities and institutes, and samples of diamondlike carbon thin films to one government agency. GRA

N81-22897# Raytheon Co., Waltham, Mass.
SYNTHESIS AND CHARACTERIZATION OF INFRARED TRANSMITTED MATERIALS Final Report, 1 Aug. 1978 - 30 Sep. 1980
Perry A. Miles, J. Pappis, and R. W. Tustison Dec. 1980 18 p refs
(Contract F49620-78-C-0109; AF Proj. 2306)
(AD-A096963; S-2855; AFOSR-81-0251TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

The objective of this program was to extend basic knowledge of the structure and properties of significant new infrared materials. Two materials were synthesized and studied: Gallium phosphide, which is of potential importance as a high durability multispectral window surfacing material and zinc selenide, the current state-of-the-art material for high quality long wavelength infrared and laser components. A new microcrystalline form of gallium phosphide was synthesized by chemical vapor deposition. It exhibited high infrared transparency and no crystals of gallium phosphide and gave new detailed information on the 3 and 4 phonon spectra at wavelengths below 12 micron. Similar spectroscopy on the infrared absorption edge of ZnSe better defined its 3 and 4 phonon spectral features and separated them from instrumental effects. A low temperature form of ZnSe synthesized by the CVD process showed impurity spectral features at wavelengths below 13 micron. They were attributed to the presence of ZnH2, H2Se and H2S complexes. Broadband internal reflection spectroscopy was carried out on ZnSe samples subjected to various organic cleansing procedures. Spectral absorption at wavelengths below 13 micron were attributed to CH2 and H2O. Other features were not identifiable. GRA

N81-22898# Arizona Univ., Tucson. Optical Sciences Center.
RESEARCH IN THE OPTICAL SCIENCES Annual Report, 1 Oct. 1979 - 30 Sep. 1980
A. B. Meinel, R. Lito, William L. Wolfe, R. V. Shack, and David Alan Thomas 30 Jan. 1981 43 p refs
(Contract F49620-80-C-0022; AF Proj. 2301)
(AD-A096979; AFOSR-81-0213TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

Contents: Two Dimensional Phenomena At Surfaces Under High Electro-Magnetic Flux, Surface and Volume Scattering of Reflectors and Refractors, Light Scattering from Reflective Optical Surfaces, New Approach to Optical Processing, Quantum Optics and Laser Physics, Interferometric Measurements of Dispersion in Optical Fiber Waveguides, Evaporated Thin Film Lens Systems for Integrated Optics, Phase Conjugation, Magnetostriction, Use of HAC Discharge Tube to Study Charge-Transfer Interactions, and Multiphoton Laser Excitation of Single Electron Atoms. GRA

N81-22899# Naval Ocean Systems Center, San Diego, Calif. Optics Lab.
DEFECT-FREE, EDGE POLISHING LITHIUM NIOBATE AND OTHER OPTICAL CRYSTALS Final Report
E. R. Schumacher Nov. 1980 18 p
(ZR0210205)
(AD-A096747; NOSC/TR-480) Avail: NTIS HC A02/MF A01 CSCL 20/2

This report documents a newly developed technique for producing defect-free edge polished lithium niobate substrates which overcomes many of the shortcomings associated with previous edge preparation techniques. The technique has been used to make successful, quantitative, repetitive, and sequential optical measurements in guided wave optical devices. Step-by-step procedures are provided. GRA

N81-22900# California Univ., Berkeley. Materials and Molecular Research Div.
NONLINEAR OPTICS AT INTERFACES Ph.D. Thesis
Chenson K. Chen Dec. 1980 85 p refs
(Contract W-7405-eng-48)
(LBL-12084) HC A05/MF A01

Two aspects of surface nonlinear optics are explored. The first is a theoretical and experimental study of nonlinear interaction of surface plasmons and bulk photons at metal-dielectric interfaces. The second is a demonstration and study of surface enhanced second harmonic generation at rough metal surfaces. A general formulation for nonlinear interaction of surface plasmons at metal-dielectric interfaces is presented and applied to both second and third order nonlinear processes. Results for coherent second and third harmonic generation by surface plasmons and surface coherent antistokes Raman spectroscopy are shown to be in good agreement with the theory. DOE

N81-22901# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
OPTICAL INTERFERENCE COATINGS FOR IMPROVED LUMINAIRE PERFORMANCE Final Report
H. L. Rubins (Optical Coating Lab., Inc., Santa Rosa, Calif.) Jan. 1981 105 p refs
(Contract W-7405-eng-48)
(LBL-12176) Avail: NTIS HC A06/MF A01

An interior broadbeam HID uplight and an upstream roadway luminaire were developed to demonstrate that optical coated luminaire components can improve the visual effectiveness and energy efficiency of a lighting system. Optical coated reflectors and flat lens covers were very effective in the development of new improved lighting techniques. The coatings reduce reflection and transmission losses, opening the door to new design options for improving lighting performance and saving energy. DOE

N81-22902# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
INTEGRATED DEVICES FOR OPTICAL RECEIVER APPLICATIONS Final Report
Klaus Berchtold Paris Bundesministerium fuer Forschung und Technologie Jun. 1980 49 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-024; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

The groundwork for integrated circuit (IC) design of optical receivers is established. Monolithic integrated receivers of varying design complexity were developed. Bipolar opto-IC's realized include (1) a photo threshold switch for exposure and illumination control with controlled hysteresis; minimum switch-on illuminance is approximately 1 lux, and (2) a photo pulse amplifier for light barriers in industrial electronics. For high sensitivity opto-IC's Bi FET technology was employed. A temperature compensated dc light amplifier was monolithically integrated; minimum switch-on illuminance is 1 mulux. For fiber optic applications, a hybrid integrated wideband amplifier with a frequency limit of 100 MHz was also developed. Electrical characterization tests and measurements for all these devices show satisfactory performance. Author (ESA)

N81-22903# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
DEVICES FOR OPTICAL SIGNAL GENERATION Final Report
Werner Schairer Bonn Bundesministerium fuer Forschung und Technologie Jul. 1980 85 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-027; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

Properties influencing the external efficiency of light emitting diodes were investigated. Specifically, the diffusion technique, the diffusion depth and the reflectivity of the contacts are causally related to low or high efficiency. Design and characteristics of high radiance emitters without heterostructure are described. Measurements, and in some cases calculations, of the heat conductance, switching times, efficiency, phase homogeneity, and linearity of the diodes are presented. The degradation of the different types of diodes is investigated. Results show that no single degradation mechanism for each type of diode can be identified. In application, monolithic integration of linear LED arrays (up to 60 elements) and discrete seven segment displays is characterized. Author (ESA)

N81-22904# Battelle Inst., Frankfurt am Main (West Germany). Hauptabteilung Physik.
DEVELOPMENT OF A HIGH-SENSITIVE BOLOMETER-DETECTOR FOR THE INFRARED REGION Final Report
Rolf Hartmann, Hillegonda Egle, and Albrecht Krah Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-33; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

The theoretical thermodynamic limit of measurement for the selected bolometer concept was determined. Experiments are described and the results prove that high sensitivity bolometers of the proposed design and with the calculated properties are feasible. On the basis of these findings, the materials used and the methods of fabrication were selected. A thin film gold bolometer whose thickness, including the carrier film, totals about 100 nm is proposed to achieve very high sensitivities at good time constants. A suitable manufacturing process for these bolometers was elaborated and tested. Author (ESA)

N81-22905# Oxford Univ. (England). Engineering Lab.
METAL COATING OF OPTICAL FIBERS
P. G. Hale, J. B. Almeida, and C. J. R. Sheppard 1980 37 p refs
(Contract SRC-G/RA/62552)
(OUEL-1306/80) Avail: NTIS HC A03/MF A01

Various methods are briefly reviewed (passing freshly drawn silica fibers through a molten aluminum blob, evaporation depositing, sputtering, chemical decomposition, electrodepositing, etc.). Magnetron sputtering was selected as the most promising. The on-line coating system developed incorporates a live cathode and a grounded anode system with a water cooled target. Outgassing and leakage problems are minimized by a permanent magnet and water ducts outside the vacuum chamber. The cylindrical magnetron sputtering device proved compatible with the drawing operation. Fibers were coated with nickel, silver, aluminum and molybdenum. Author (ESA)

N81-22394*# American Science and Engineering, Inc., Cambridge, Mass.
A SYSTEMS APPROACH TO MECHANISMS FOR A WHITE LIGHT CORONAGRAPH X-RAY XUV TELESCOPE
Richard Mastronardi and Richard E. Cabral *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 77-90 (For primary document see N81-22388 13-39) (Grant NSF ATM-77-23757)
Avail: NTIS HC A19/MF A01 CSCL 20F

N81-22403*# Sener, S.A., Madrid (Spain). Dept. Aerospacial.
DESIGN AND DEVELOPMENT OF AN OPTICAL SCANNING MECHANISM (OSMA) WITH MINIMUM MOMENTUM TRANSFER
Leandro B. Fernandez Sainz, Erardo Herrera, Jose M. Bajo, and Harry J. Mallard *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 219-234 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-22906 California Univ., Irvine.
LINE TYING AND CROSS-FIELD PLASMA CONVECTION Ph.D. Thesis
Steven Wayne Fornaca 1980 286 p
Avail: Univ. Microfilms Order No. 8106775

The effects of line tying on the curvature-driven convection of plasma across magnetic field lines in open ended confinement systems were investigated. Line tying is defined as the electrical contact between the plasma and a conducting end wall. On the basis of existing theoretical models of the line tying process, the motion of the plasma in terms of measurable parameters is predicted and predictions are tested experimentally. The experiments were performed in Q machines using low Beta, higher density, collisionless plasmas. The driving force for the plasma convection was provided by magnetic curvature; both toroidal and mirror geometries were used. The degree of line tying, which is dependent upon the sheath conditions at the wall-plasma interface was controlled by changing the amount of electron emission from the end wall surface. The experiment was repetitively pulsed and sampling techniques were used in conjunction with Langmuir probes to determine the plasma position as a function of time. Dissert. Abstr.

N81-22907 California Univ., San Diego.
THE EFFECT OF MAGNETIC FIELD ASYMMETRICS IN A PURE ELECTRON PLASMA Ph.D. Thesis
Rhonald Kaye Keinigs 1980 91 p
Avail: Univ. Microfilms Order No. 8107466

The effect of static magnetic field perturbations on the low frequency spectrum of a pure electron plasma column was investigated. An asymmetry in the confining magnetic field is introduced into an otherwise cylindrically symmetric system by superimposing on the axial field, a small field error, which produces a charge bunching that can resonantly drive electrostatic waves. The driver modes have frequencies near omega = 0, and within a linear analysis their amplitude increses linearly with time. As a wave grows it drives currents in the plasma and produces radial transport. This transport results from a torque arising from the interaction of the driven currents with the magnetic field error. The largest transport is found to be due to a finite k diocotron wave. A nonlinear fluid analysis reveals that the model amplitude oscillates because of a nonlinear shift in the rotation frequency of the column. When damping is added to the nonlinear equations, the potential approaches a limiting value that is finite, and 90 deg out of phase with the driver. Dissert. Abstr.

N81-22908 Princeton Univ., N. J.
ULTRA-SOFT X-RAY EMISSION FROM THE PRINCETON LARGE TORUS TOKAMAK Ph.D. Thesis
David Robson Eames 1981 216 p
Avail: Univ. Microfilms Order No. 8108088

The ultra soft X-ray emission (USX) is often a significant energy loss mechanism, and is an excellent tool for monitoring particle transport and magnetic field evolution. A rotating crystal spectrometer with lambda/delta lambda = 400 was constructed and used to measure the USX spectrum every 100 ms. Oxygen K and iron L spectra were prominent constituents, and radial emission profiles of charge states Fe XVII to Fe XXIV were obtained. The experimentally deduced radical locations of the peaks for each charge state were radically shifted outward for the lower charge states when compared with theoretical predictions based on coronal equilibrium. Dissert. Abstr.

N81-22909 Pennsylvania State Univ., University Park.
EXPERIMENTAL INVESTIGATION OF ENERGY LOSS AND END LOSS PHYSICS IN A LINEAR THETA PINCH Ph.D. Thesis
Barry Alan Jacoby 1980 194 p
Avail: Univ. Microfilms Order No. 8107584

The results of an experimental study of particle and thermal loss processes from a 50 cm long theta pinch are presented. The plasma was generated with a 40 m Torr fill of deuterium in a 3.81 cm radius discharge tube; 67 percent Z preionization was followed by a main current discharge that produced a 23 kG peak magnetic field in 4.75 microseconds. The electron density and temperature in the plasma column at the end of dynamic implosion were characterized by 1.0 x 10 to the 16th power cu cm and 20 eV, respectively. This was followed by adiabatic compression which occurred with the particle and energy loss of interest. The diagnostics employed in this experiment were Thomson scattering, continuum radiation spectroscopy, local magnetic field probes, local pressure probes, and diamagnetic loops. Axial temperature and density profiles were mapped from the coil into the end region. At positions in the end region 9 cm and 12 cm from the coil end, plasma wall contact occurred; a radial scan of temperature and density was made at these axial positions using Thomson scattering. Dissert. Abstr.

N81-22910 Princeton Univ., N. J.
THE MPD THRUSTER ONSET CURRENT PERFORMANCE LIMITATION Ph.D. Thesis
Lowell Kevin Rudolph 1981 218 p
Avail: Univ. Microfilms Order No. 8106920

Studies of a quasi steady self-field magnetoplasma dynamic (MPL) arcjet at increasing discharge currents confirmed the coincidence of an increasing ablation rate with the onset of oscillations in the terminal voltage. These oscillations arise for discharge currents above a particular value referred to as the onset current, and demark a bound on acceptable arcjet behavior. Due to the monotonic increases in arcjet specific impulse, thrust, and thrust efficiency with discharge current, the arcjet performance as a spacecraft thruster is effectively limited by this onset current. In addition to its dependence on propellant mass flow rate, the onset current also varies with discharge chamber pressure and cathode length. Detailed performance measurements show that the inferred specific impulse with argon propellant form 875 sec to 2100 sec, and the inferred thrust efficiency increased from 12% to 30% by increasing the cathode length from 2.5 cm to 10 cm. Dissert. Abstr.

N81-22911 Princeton Univ., N. J.
LOW ENERGY NEUTRAL ATOM EMISSION AND PLASMA RECYCLING IN THE PLT TOKAMAK Ph.D. Thesis
Donald Edward Voss 1981 195 p
Avail: Univ. Microfilms Order No. 8107434

A time of flight diagnostic has been developed to measure the energy spectrum of neutral deuterium atoms emitted from the PLT Tokamak plasma in the energy range from 20 to 1000 eV. During an entire discharge, the energy spectrum is monotone decreasing with energy at energies above 100 eV. Early in a discharge, emission is dominantly at low energy with the spectral shape characteristic of a single temperature source, with measured ion temperatures as low as 18 eV at 5 msec from initiation. After 50 msec the spectral shape reflects development of an ion temperature profile in minor radius. During steady state the I/e decay constant of the energy spectrum varies from roughly 100 eV at energies E approximately < 200 eV to about 400 eV at higher energies 500 approximately < E approximately< 1000 eV. A common feature of all discharges is a burst of neutral atom outflux at initiation which is typically 25 times more intense than steady state emission, as well as a similarly intense burst at termination. A model is presented which determines both the magnitude and time evolution of the start up burst from toroidally symmetric volume processes driven by the torus fill gas. Dissert. Abstr.

N81-22912# New York Univ., N. Y. Magneto-Fluid Dynamics Div.
MOTION OF A CHARGED PARTICLE IN A NEARLY AXISYMMETRIC MAGNETIC FIELD
Harold Weitzner Nov. 1980 59 p
(Contract DE-AC02-76ER-03077; Grant AF-AFOSR-2881-76)
(DOE/ER-03077/169) Avail: NTIS HC A04/MF A01

The motion of a charged particle in a static magnetic field is studied by means of repeated canonical transformations of a Hamiltonian system. Adiabatic invariants are generated based on the assumption that the particle larmor radius is small compared with the characteristic distance over which the magnetic field varies. Unlike many earlier treatments the transformations presented here preserve the axisymmetry of the dynamics when the magnetic field is axisymmetric. It is assumed that the magnetic field consists of a small nonaxisymmetric part plus the axisymmetric toroidal and poloidal parts. After the introduction of the magnetic moment adiabatic invariant, the motion of the guiding center is studied. The results depend sensitively on the ratio of the poloidal magnetic field to the total magnetic field. In some cases a second adiabatic invariant exists and direct inferences concerning long time particle drifts are possible. In one case where a second adiabatic invariant fails to exist, long term drifts are studied by conventional perturbation expansions. At some points resonance or lack of resonance phenomena appear and determine the drift effects. DOE

N81-22913# Illinois Univ., Urbana. Fusion Studies Lab.
OVERVIEW OF ALTERNATE-FUEL FUSION
George H. Miley 1980 17 p refs Presented at the 3rd Miami Intern. Conf. on Alternate Energy Sources, Miami Beach, Florida, 15-17 Dec. 1980
(Contract DE-AS02-76ET-52040)
(COO-2218-199; CONF-801210-15) Avail: NTIS HC A02/MF A01

Alternate fuels such as catalyzed deuterium (Cat-D), D-He-3, and proton-B-11 offer the potential advantages of elimination of tritium breeding and reduced energy release in neutrons. An adequate energy balance appears exceedingly difficult to achieve with proton-based fuels such as P-(B-11). Thus Cat-D, which can ignite at temperatures in the range of 30 to 40 KeV, represents the logical near-term candidate. An attractive variation which adds flexibility would be to develop semi-catalyzed-D for synfuel production with simultaneous generation of He-3 for use in satellite electrical power plants. These approaches and problems are discussed. DOE

N81-22914*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FAST PLASMA HEATING BY ANOMALOUS AND INERTIAL RESISTIVITY EFFECTS
Andre Duijveman (Astronomical Inst., Utrecht), Peter Hoyng, and James A. Ionson Mar. 1981 37 p refs Submitted for publication
(NASA-TM-82107) Avail: NTIS HC A03/MF A01 CSCL 20I

Fast plasma heating by anomalous and inertial resistivity effects is described. A small fraction of the plasma contains strong currents that run parallel to the magnetic field and are driven by an exponentiating electric field. The anomalous character of the current dissipation is caused by the excitation of electrostatic ion cyclotron and/or ion acoustic waves. The role of resistivity due to geometrical effects is considered. Through the use of a marginal stability analysis, equations for the average electron and ion temperatures are derived and numerically solved. The evolution of the plasma is described as a path in the drift velocity diagram, in which the drift velocity is plotted as a function of the electron to ion temperature ratio. E.A.K.

N81-22915*# National Aeronautics and Space Administration, Washington, D. C.
PLASMA WAVES IN A RELATIVISTIC, STRONGLY ANISOTROPIC PLASMA PROPAGATED ALONG A STRONG MAGNETIC FIELD
O. G. Onishchenko Jun. 1980 22 p refs Transl. into ENGLISH of "Plazmennyye Volny v Relyativistskoy Silnoanizotropnoy Plazme, Rasprostranyayushiyesya Vdol Sinnogo Magnitnogo Polya" Moscow, 1978 20 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-76240; Pr-398) Avail: NTIS HC A02/MF A01 CSCL 20I

The dispersion properties of plasma waves in a relativistic homogeneous plasma propagated along a strong magnetic field are studied. It is shown that the non-damping plasma waves exist in the frequency range omega sub p < or = omega < or = omega sub L. The values of omega sub p and omega sub L are calculated for an arbitrary homogeneous relativistic function of the particle distribution. In the case of a power ultrarelativistic distribution, it is shown that, if the ultrarelativistic tail of the distribution drops very rapidly, slightly damping plasma waves are possible with the phase velocity (omega/K)< c. M.G.

N81-22916# Colorado Univ. at Boulder. Dept. of Astro-Geophysics.
PLASMA WAVE TURBULENCE AND PARTICLE HEATING CAUSED BY ELECTRON BEAMS, RADIATION AND PINCHES Interim Report, 1 Oct. 1979 - 30 Sep. 1980
Martin V. Goldman Jan. 1981 352 p refs
(Grant AF-AFOSR-0022-80; AF Proj. 2301)
(AD-A096560; CU-1533143; AFOSR-81-0148TR) Avail: NTIS HC A16/MF A01 CSCL 04/1

The subject of research has been the theory of 'Plasma Wave Turbulence and Particle Heating Caused by Electron Beams, Radiation, and Pinches.' The period covered is the third stage of a comprehensive research program concerned with the nonlinear behavior of plasmas subjected to intensely energetic sources. One of the significant developments in plasma physics over the

past decade has been the theoretical and experimental progress made in our understanding of nonlinear plasma wave evolution in response to external sources: A wide variety of radiation sources such as lasers, microwaves, and radar, and of electron beam sources, such as solar electron streams, and laboratory beams can excite plasma wave instabilities in target plasmas. the waves saturate into a turbulent spectrum, and may heat the plasma, accelerate plasma particles, and/or emit their own radiation. Such processes have been linked to inertial and magnetic controlled thermonuclear fusion schemes, radar communications in the earth:s ionosphere, and Type III solar radio bursts. The phenomena also bear heavily on certain fundamental questions of plasma turbulence, such as wave collapse in phase space, electric-field envelope-soliton evolution, and the nature of the so-called 'strong turbulance.' GRA

N81-22917# Old Dominion Univ., Norfolk, Va. Dept. of Electrical Engineering.

RADIATION PRODUCTION BY CHARGED PARTICLE BEAMS EJECTED FROM A PLASMA FOCUS Final Technical Report, 15 Jul. 1979 - 31 Oct. 1980

G. Marshall Molen 1 Feb. 1981 25 p refs
(Contract F49620-79-C-0151; AF Proj. 2301)
(AD-A096964; AFOSR-81-0282TR) Avail: NTIS HC A02/MF A01 CSCL 20/9

The scope of this investigation concerns the development of a pulsed radiation source using the charged particle beam ejected from a plasma focus device. The concept represents a rather simple method of producing intense bursts of relatively soft X-rays for applications such as the testing of satellite components for radiation hardening and survivability. The plasma focus is operated in a modified geometry such that electron bursts which originate in the plasma column at the onset of the plasma pinch are transported from the focus region to a target chamber by means of a conductive drift tube. X-rays are produced at a converter by thick-target bremsstrahlung. This report describes the progress that has been made in the construction of such a radiation facility. The plasma focus, identified as the Mark IV, is nominally rated at 34 kJ with a capacitance of 168 micro F at 20 kV. The current status of the investigation is such that the device after considerable modifications, is now operational and diagnostic hardware is being developed to measure the electron bursts from the dense plasma. GRA

N81-22918# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.

SOURCE EFFECTS ON IMPURITY AND HEAT TRANSPORT IN A TOKAMAK

R. B. Bennett Dec. 1980 4 p
(Contract DE-AS05-78ET-52025)
(DOE/ET-52025/21) Avail: NTIS HC A02/MF A01

Neoclassical theory is extended here to study heat flux contributions to impurity transport, as well as the heat fluxes themselves. The theory accounts for the first four source moments, with external drags, which were studied previously with either fewer moments or restricted to a collisional plasma. Conditions are established for which a momentum source may be used to modify the particle and heat transport. Particle and heat transport are evaluated for a two species plasma with arbitrary plasma geometry, beta, and collisionality. DOE

N81-22919# Illinois Univ., Chicago. Nuclear Engineering Program.

ENERGY-DEPENDENT FINITE-ORBIT TREATMENT FOR PLASMA BUILDUP IN MIRROR FUSION DEVICES Ph.D. Thesis

Mark Mundy Campbell 1980 166 p refs
(Contract DE-AC02-76ER-01198)
(COO-2218-200) Avail: NTIS HC A08/MF A01

A computer simulation of hot plasma buildup in mirror fusion devices and results from this model are presented. In a small, hot magnetically confined plasma, the ion orbit radius (rho/sub i/) can be comparable to the plasma radius (R/sub p/). If a mirror confined plasma were rho/sub i/R/sub p/ > 1/25 (such as 2XII-B), a point kinetic treatment of ion interactions becomes inaccurate and a finite gyro radius (FGR) treatment must be used to adequately describe plasma buildup processes. This is particularly true for describing losses due to cold gas charge exchange (c-x) near the plasma surface, since a particle lost near the vacuum interface may have contributed to the density as far as 2 rho/sub i/ radially inward from the c-x point. A similar FGR effect applies to beam deposited ions whose large orbits influence the density up to 2 rho/sub i/ from the trapping point. DOE

N81-22920# Texas Univ., Austin. Inst. for Fusion Studies.

UNIFIED KINETIC THEORY IN TOROIDAL SYSTEMS

D. A. Hitchcock, R. D. Hazeltine, and S. M. Mahajan Dec. 1980 31 p refs
(Contracts DE-FG05-80ET-53088; DE-AC05-76ET-53036)
(DOE/ET-53088/4) Avail: NTIS HC A03/MF A01

The kinetic theory of toroidal systems is normally characterized by two approaches: neoclassical theory which ignores instabilities and quasilinear theory which ignores collisions. A kinetic theory for toroidal systems was developed which includes both effects. This yields a pair of evolution equations; one for the spectrum and one for the distribution function. In addition, this theory yields a toroidal generalization of the usual collision operator which is shown to have many similar properties - conservation laws, H theorem - to the usual collision operator. DOE

N81-22921# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.

EFFECT OF A LOCALIZED MAGNETIC PERTURBATION ON MAGNETIC ISLANDS IN A CYLINDRICAL PLASMA

G. Bateman and R. N. Morris May 1980 36 p refs
(Contract DE-AS05-78ET-52025)
(DOE/ET-52025/15) Avail: NTIS HC A03/MF A01

It is found that localized perturbations tend to produce poloidally symmetric annular ergodic regions and poloidally elongated magnetic islands rather than simple magnetic islands. The plasma model takes into account the flattening of the current profile across each annular ergodic region and the concommitant steepening of the current profile between ergodic regions. Using current profiles inferred from experimental data, saturated tearing mode amplitudes were computed and found to agree with the experimentally observed Mirnov oscillation amplitudes. As the applied magnetic perturbation is turned on and increased, it is observed that the steepened current profile and resulting enhancement of tearing modes produces wider ergodic regions than would be expected from the vacuum magnetic perturbation alone. DOE

N81-22922# Washington Univ., Seattle. Aerospace and Energetics Research Program.

INVESTIGATION OF COMPACT TOROID PHYSICS Annual Report, period ending 30 Sep. 1980

G. C. Vlases and Z. A. Pietrzyk 1980 107 p refs
(Contract DE-AT06-76ET-53047)
(DOE/ET-53047/18) Avail: NTIS HC A06/MF A01

Aspects of the advanced fusion concepts program were investigated. Progress is reported in the following areas: (1) initiation of a small high density compact toroid experiment of the FRC configuration, characterized by no toroidal field and high (beta); (2) construction and testing of an imploding shell device for plasma heating; and (3) two dimensional modeling of CT-FRC plasmas for internal use, as well as for interpretation and predictions for experiments at LASL and MSNW. Material and plugging of dense linear open field plasma columns is included. DOE

N81-22923# Columbia Univ., New York. School of Engineering and Applied Science.

INTERACTION OF GRAPHITE WITH A HOT, DENSE DEUTERIUM PLASMA

J. C. Desko, Jr. 1980 101 p refs
(Contract DE-AS02-77ET-52008)
(DOE/ET-52008/1) Avail: NTIS HC A06/MF A01

The erosion of ATJ-S graphite caused by a hot, dense deuterium plasma was investigated experimentally. The plasma was produced in an electromagnetic shock tube. Plasma characteristics were typically: ion temperature approximately equal to 800 eV (ten million degrees Kelvin), number density approximately equal to 10 to the 16th power/cu cm, and transverse magnetic field approximately equal to 1 tesla. The energetic ion flux, phi, to the sample surfaces was approximately 10 to the

23rd power ions/sq cm/sec for a single pulse duration of approximately 0.1 usec. Sample surfaces were metallographically prepared and examined with a scanning electron microscope before and after exposure. DOE

N81-22924# California Univ., Livermore. Lawrence Livermore Lab.

PLASMA EFFECTS IN HIGH FREQUENCY RADIATIVE TRANSFER

C. T. Alonso 8 Feb. 1981 60 p refs
(Contract W-7405-eng-48)
(UCID-18913) Avail: NTIS HC A04/MF A01

A survey of collective plasma processes which can affect the transfer of high frequency radiation in a hot dense plasma is given. For pedagogical reasons plasma processes are examined by relating them to a particular reference plasma which consists of fully ionized carbon at a temperature kT = 1 KeV (ten million degrees Kelvin) and an electron density N = 3 x 10 to the 23rd power/cu cm, (which corresponds to a mass density rho = 1 gm/cu cm) and an ion density N sub i = 5 x 10 to the 22nd power/cu cm. The transport of photons, ranging from 1 eV to 1 KeV in energy, in such plasmas is considered. Such photons are to be used as diagnostic probes of hot dense laboratory plasmas. DOE

N81-22925# California Univ., Livermore. Lawrence Livermore Lab.

GYROELASTIC FLUIDS

G. D. Kerbel 20 Jan. 1981 132 p refs
(Contract W-7405-eng-48)
(UCRL-53101) Avail: NTIS HC A07/MF A01

A scale model (in three dimensions) of a guiding center plasma was studied within the purview of gyroelastic (finite gyroradius near theta pinch) magnetohydrodynamics. The nonlinear system sustains a particular symmetry called isorrhopy which permits the decoupling of fluid modes from drift modes. Isorrhopic equilibria were analyzed within the framework of geometrical optics resulting in local dispersion relations and ray contants. A general scheme was developed to evolve an arbitrary linear perturbation of a screwpinch equilibrium as an invertible integral transform (over the complete set of generalized eigenfunctions defined naturally by the equilibrium). The structure of the function space and the associated spectra are described as well as features of the global dispersion relation due to the presence of gyroelastic stabilization. An energy principle is developed to study the stability of the tubular screwpinch. DOE

N81-22926# California Univ., Livermore. Lawrence Livermore Lab.

SOFT X-RAY STREAK CAMERA FOR LASER FUSION APPLICATIONS M.S. Thesis

Gary L. Strading Apr. 1981 83 p
(Contract W-7405-eng-48)
(UCRL-52568) Avail: NTIS HC A05/MF A01

The development and significance of the soft x-ray streak camera (SXRSC) in the context of inertial confinement fusion energy development is reviewed as well as laser fusion and laser fusion diagnostics. The SXRSC design criteria, the requirement for a subkilovolt X-ray transmitting window, and the resulting camera design are explained. Theory and design of reflector-filter pair combinations for three subkilovolt channels centered at 220 eV, 460 eV, and 620 eV are also presented. Calibration experiments are explained and data showing a dynamic range of 1000 and a sweep speed of 134 psec/mm are presented. Sensitivity modifications to the soft X-ray streak camera for a high-power target shot are described. A preliminary investigation, using a stepped cathode, of the thickness dependence of the gold photocathode response is discussed. Data from a typical Argus laser gold-disk target experiment are shown. DOE

N81-22927# Los Alamos Scientific Lab., N. Mex.

COMMENTS ON THE CRITICAL ISSUES FOR A HIGH-DENSITY GAS-EMBEDDED Z-PINCH CTR REACTOR CONCEPT

Carl A. Ekdahl Feb. 1981 13 p refs
(LA-8680-MS) Avail: NTIS HC A02/MF A01

The issues considered critical for the realization of a CTR reactor are discussed for the high density gas embedded z pinch concept. A simple model of the pinch reactor is presented that gives estimates for Q in substantial agreement with elaborate computer studies. An attempt is made to identify such critical points that are amenable to exploratory experiments. There appears to be no fatal flaw in the issues covered that would preclude a viable reactor based on this concept. Author

N81-22928# Oak Ridge National Lab., Tenn.

TEARING MODE STABILITY OF TOKAMAK PLASMAS WITH ELLIPTICAL CROSS SECTION

B. A. Carreras, J. A. Holmes, H. R. Hicks, and V. E. Lynch Feb. 1981 33 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7591) Avail: NTIS HC A03/MF A01

The effect of the ellipticity of the plasma cross section on tearing mode stability is investigated. The induced coupling between modes is shown to be destabilizing; however, the modification of the equilibrium tends to stabilize the tearing modes. The net effect depends on the manner in which the equilibrium is modified as the plasma cross section shape is changed. DOE

N81-22929# Oak Ridge National Lab., Tenn. Engineering Physics Div.

NEUTRON AND GAMMA RAY STREAMING CALCULATIONS FOR THE ETF NEUTRAL BEAM INJECTORS

R. A. Lillie, R. T. Santoro, R. G. Alsmiller, Jr., and J. M. Barnes Feb. 1981 25 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7705) Avail: NTIS HC A03/MF A01

Two dimensional radiation transport methods were used to estimate the effects of neutron and gamma ray streaming on the performance of the engineering test facility neutral beam injectors. The calculations take into account the spatial, angular, and spectral distributions of the radiation entering the injector duct. The instantaneous nuclear heating rate averaged over the length of the cryopumping panel in the injector is 7.5 x 10(+3) MW/m(3) which implies a total heat load of 2.2 x 10(+4) MW. The instantaneous dose rate to the ion gun insulators was estimated to be 3200 rad/s. The radial dependence of the instantaneous dose equivalent rate in the neutral beam injector duct shield was also calculated. DOE

N81-22930# Oak Ridge National Lab., Tenn.

ELMO BUMPY TORUS DATA BASE

J. S. Stanton Mar. 1981 82 p
(Contract W-7405-eng-26)
(ORNL/CSD/TM-136) Avail: NTIS HC A05/MF A01

A set of computer programs developed to facilitate storage and retrieval of data generated by the ELMO Bumpy Torus (EBT) experiment are described. The data are stored in a collection of files which contain either raw or analyzed data from diagnostics connected to the experiment. An on line index of steady state machine conditions, diagnostic or analysis status information, and raw or analyzed data values unifies the file collection into a data base. The index is implemented under the system 1022 data base management system. DOE

N81-22931# California Univ., Berkeley. Accelerator and Fusion Research Div.

PLASMA NEUTRALIZERS FOR H NEGATIVE OR D NEGATIVE BEAMS

K. H. Berkner, R. V. Pyle, S. E. Savas, and K. R. Stalder Oct. 1980 8 p refs Presented at the 2nd. Intern. Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N.Y., 6-10 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11640; CONF-801068-20) Avail: NTIS HC A02/MF A01

Plasma neutralizers can produce higher conversion efficiencies than are obtainable with gas neutralizers for the production of high-energy neutral beams from negative hydrogen ions. Little attention has been paid to experimental neutralizer studies because of the more critical problems connected with the development of negative-ion sources. With the prospect of accelerating ampere dc beams from extrapolatable ion sources some time next year, plasma neutralizers are being re-examined. Some basic considerations, two introductory experiments, and a next-step experiment are described. DOE

N81-22932# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
[REPORT ON ACTIVITIES IN FUSION RESEARCH AND DEVELOPMENT FOR 1979] Annual Report
May 1980 97 p refs
(Rept-ASR-1979) Avail: NTIS HC A05/MF A01

Experimental and theoretical investigations of fusion physics are reported on. Experimental projects include investigations of pinches, turbulent heating (TORTUR), gas blanket research, and diagnostics. Theoretical studies cover magnetohydrodynamics, wave dynamics, and transport problems. Also considered are quantum mechanical methods and reactor problems. The activities of the electrotechnical and mechanical engineering departments are described. Author (ESA)

N81-22933# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
THEORETICAL ANALYSIS AND EXPERIMENTAL MEASUREMENTS ON UNSTABLE TOROIDAL CAVITIES WORKING UNDER A CW-CO2 LASER AT FAST FLOW [ANALISI TEORICA E MISURE SPERIMENTALI SU CAVITA INSTABILI TOROIDALI OPERANTI SU LASER CW-CO2 A FLUSSO VELOCE]
R. Canevari, A. Borghese, V. Donati, and L. Garifo 1980 13 p refs In ITALIAN Presented at 2nd Matl. Congr. of Quantum and Plasma Electrom., Palermo, Italy, 20-22 May 1980
(Contract CNR/CISE-79.01579.98)
(CISE-1641) Avail: NTIS HC A02/MF A01

The cavity is optically defined by the curvature radius of a convex and a concave mirror. The resulting laser beam leaves the cavity under the lower rim of the convex mirror. The radiation intensity distribution is related to the four curvature radii. The resulting rectangular beam has a cylindrical wave front. The wave propagation and the beam focusing are discussed. Higher power densities than those attainable from commercial CW-CO2 lasers were sought. It is shown that the optical efficiency, defined as the ratio of power density in the central lobe to power available, is a high as 65%, and higher than in other reference unstable resonators. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N81-22934 Princeton Univ., N. J.
HIGH ENERGY ABSORPTION SPECTRA OF THE FIRST ROW TRANSITION METAL IONS IN THE LITHIUM CHLORIDE SINGLE CRYSTAL HOST Ph.D. Thesis
John Joseph Simonetti, Jr. 1981 222 p
Avail: Univ. Microfilms Order No. 8107433

A systematic study was conducted in order to examine the first row transition metal ions, in the 2+ oxidation state, substitutionally doped into the simple cubic LiCl crystal system. A modified bridgeman method was used in the crystal growth procedure. The exact conditions for preparation of each doped single crystal are given. The LiCl lattice provides high solid solubility for the impurities of interest. It also transmits energy farther into the UV than does any other chloride host. However, due to the extreme affinity of LiCl for water, special techniques and equipment were developed for the preparation of single crystal specimens for spectroscopic study. The resulting crystals were found to be of very high purity, containing only the doped ion of interest. This allowed an unambiguous interpretation of the observed absorption bands in the ultraviolet region. The UV absorption spectra are given for each impurity ion at 10 K, 80 K, and 300 K. Dissert. Abstr.

N81-22935 Wisconsin Univ. - Madison.
LASER SPECTROSCOPY OF DEFECT CLUSTERS IN DOPED CALCIUM FLUORIDE Ph.D. Thesis
Mark Bryan Seelbinder 1980 230 p
Avail: Univ. Microfilms Order No. 8102224

The results of a site selective laser study into the spectral and temporal behavior of Ho(3+) doped into calcium fluoride are reported. It is shown that two optically-active single pair sites are present, corresponding to the trigonal and tetragonal sites. A method of correlating the identity of cluster sites occurring in any rare earth-dopant system is discussed. This technique based on site-selective excitation and energy transfer between dissimilar ions, involved the choice of Y6(3+) as a cluster-site transfer standard, which could be doped into a system along with any arbitrary second rate earth. Results of investigations of a three-body cooperative upconversion process are also reported. This process is found to occur in the CaF2:Y6(3+), T6(3+) system. Dissert. Abstr.

N81-22936 Arizona Univ., Tucson.
EXPERIMENTAL STUDIES OF QUANTUM MECHANICAL INTERFERENCE EFFECTS IN MAGNETORESISTANCE OF SINGLE CRYSTALS OF ULTRAPURE MAGNESIUM Ph.D Thesis
Niranjan Bhogilal Sandesara 1980 124 p
Avail: Univ. Microfilms Order No. 8107441

Quantum interference oscillations in transverse magnetoresistance of ultrapure magnesium single crystals occur as a function of the angle of rotation when the current is passed along the [1120] direction and the magnetic field vector H is rotated by approximately < 1 deg from [1010] toward the [0001] symmetry axis. To characterize the oscillations, quantitative data were taken for fields up to 24 kG and for temperatures in the range of 1.4 K to 4.2 K. These angles are shown to have the same origin as the field dependent interferometer oscillations reported by Starck and Friedberg. Both types of oscillations arise from the electron quantum states on the coupled orbit network, which is obtained for vector H parallel to [1010]. High sensitivity of the oscillations and the background magnetoresistance to field inhomogeneity and crystal strain yields strong evidence for a new regime of quantum transport. Band structure calculations firmly establish that the large oscillations arise from the symmetry breaking of the two interferometer lobes as the field is rotated away from [1010]. Dissert. Abstr.

N81-22937 Arizona State Univ., Tempe.
ANALYSIS OF IMPACT IONIZATION AND ENHANCED CAPACITANCE IN METAL OXIDE SEMICONDUCTOR STRUCTURES Ph.D. Thesis
William Walter Lattin 1980 166 p
Avail: Univ. Microfilms Order No. 8107066

Two important MOS device physics phenomena are analyzed. The first is impact ionization in MOS device structures. Impact ionization current flows in the substrate of a MOS device which is operated in the saturation region. This current results from hole electron pair created by impact ionization in the drain depletion region. The second phenomenon is the enhanced capacitance of a special MOS device called the enhanced capacitor. The small signal capacitance is calculated from basic device physics and compared with measured data.Dissert. Abstr.

N81-22938 California Univ., Santa Barbara.
NONRADIATIVE ENERGY TRANSFER FROM ATOMS TO SURFACE PLASMONS Ph.D. Thesis
Arnold Lucian Adams 1980 159 p
Avail: Univ. Microfilms Order No. 8107695

Luminescent molecules near metal surfaces can have dramatically decreased quantum efficiencies and lifetimes. Decreases of approximately 10 to the 4th power in quantum efficiency and in lifetime occur for nitrogen atoms within 3 nm of potassium surfaces. Experimental decay curves are presented for light emission from N atoms in an N2 matrix of varying thickness (3 to 1000 nm) on sapphire, silver, sodium and potassium substrates. Theoretical decay curves are derived and found to be in agreement with the experimental curves. Both experiment and theory agree that for thick potassium films there is near resonant coupling between excited nitrogen atoms and potassium surface plasmons. For metal films, both film thickness and surface roughness affect the decay curves. Dissert. Abstr.

N81-22939 Florida State Univ., Tallahassee.
UV LASER AND X-RAY RADIATION DAMAGE TO L-ASCORBIC ACID SINGLE CRYSTALS FROM 77 K TO 300 K: ESR ANALYSIS Ph.D. Thesis
Graham Fischer McDearmon 1980 161 p refs

Avail: Univ. Microfilms Order No. 8108399

Single crystals of 1-ascorbic acid and partially deuterated l-ascorbic and were irradiated in the temperature range of 77 K to 300 K by either X-rays from a 3 Mev Van de Graaff electron accelerator or UV radiation (337.1 nm) from a pulsed nitrogen gas laser having a peak power of 240 KW. Several types of free radicals were produced by the radiation and were studied by X-band and Q-band ESR from 4.2 K to 300 K. The kinds of radicals produced by the UV and X-irradiation were the same. The intensities of the spectral lines of the different types of radicals depend upon both the temperature and the type of radiation. Four radicals were identified: two oxidation products, one neutralized anion, and one adduct. All four radicals are carbon based radicals and are located on the furan ring. All hyperfine couplings are Beta protons. No carbon-13 hyperfine couplings were observed. Dissert. Abstr.

N81-22940 Illinois Univ. at Chicago Circle, Chicago.
STRUCTURE AND MELTING OF A TWO-DIMENSIONAL SOLID: A STUDY OF METHANE ON GRAPHITE BY NEUTRON SCATTERING Ph.D. Thesis
Parul Vora 1980 135 p
Avail: Univ. Microfilms Order No. 8106862

A fairly detailed phase diagram for methane on graphite as a function of coverage and temperature is presented. The different phases were identified by studying the methane diffraction peaks. The peaks were fitted to a derived lineshape which assumed perfect correlation up to a finite cluster size L of the methane lattice. The behavior of the parameters, d the lattice spacing, L the cluster size and A the amplitude of the peak, were used to distinguish the phases and locate the phase boundaries. Melting to a fluid phase was found to exist via an incommensurate phase. Some light was shed on the registered to compressed solid transition and also the expanded to compressed solid transition. The experiments also show a lack of orientational order of the methane molecules. Dissert. Abstr.

N81-22941 Illinois Univ. at Chicago Circle, Chicago.
MAGNETISM AND ATOMIC SHORT-RANGE ORDER IN Ni-Cu Ph.D. Thesis
Charles James Tranchita 1980 154 p
Avail: Univ. Microfilms Order No. 8106861

In NiCu alloys, it is recognized that local environment effects are critical in determining the magnetic moments of the Ni atoms. Thus, changes in chemical short range order cause large changes in the magnetic properties of NiCu alloys. Because of metallurgical problems care has to be taken to obtain homogeneous alloys without any gradient in the degree of chemical short range order. The a.c. susceptibility homogeneous Ni sub 1-x Cu sub x alloys near the critical concentration for ferromagnetism were measured, both as a function of concentration and degree of chemical short range order. The susceptibility vs. temperature curves display a fairly sharp peak at a temperature T sub M which for ferromagnetic alloys is equal to the Curie temperature. The width of the peak is a good indication of the homogeneity of the sample. As T sub M drops below 4 K the alloys are no longer ferromagnetic but with susceptibility peaks resembling those of spin glass alloys. Dissert. Abstr.

N81-22942 Kent State Univ., Ohio.
ROTATIONAL DIFFUSION IN NEMATIC LIQUID CRYSTALS Ph.D. Thesis
Bernard Lee Richards 1980 74 p
Avail: Univ. Microfilms Order No. 8108107

Diffusion coefficients are calculated for thermotropic nematic liquid crystals utilizing an angular velocity correlation formalism and a microscopic molecular model. The model assumes no explicit coupling between the rotational and translational motions and supposes that the angular molecular position changes only slightly in the time during which the angular velocity correlation changes significantly. In the first model a molecular dynamics formalism is used which incorporates a concept in which the angular velocity is assumed to be randomized during an intermolecular collision. In the second model, a Fokker-Planck equation is used to describe the diffusion process. Dissert. Abstr.

N81-22943 Missouri Univ. -Rolla.
INTERFACE STATES IN GaAs OXIDE-METAL SCHOTTKY DIODES Ph.D. Thesis
Yen Chang Wu 1980 77 p
Avail: Univ. Microfilms Order No. 8108114

The electronic states at oxide interfaces of various metal oxide gallium arsenide structure were measured by a.c. capacitance as a function of forward bias. The equivalent circuit developed by Kar and Dahlke was used to analyze the circuit. The metals used were aluminum and silver. Nondegenerate n-type gallium arsenide oxide aluminum shows a measurable density of interface states about 10 to the 11th power/sq cm/eV at 5 kHz with the states having a peak at 0.30 V above the Fermi level. The silver oxide gallium arsenide sample had a smaller density of interface states than aluminum oxide gallium arsenide. Dissert. Abstr.

N81-22944 Missouri Univ. -Rolla.
AMORPHOUS-DAMAGE DEPTH DISTRIBUTIONS AND THE AMORPHIZATION OF SILICON BY ION BOMBARDMENT Ph.D. Thesis
Joseph Peter Sadowski 1980 296 p
Avail: Univ. Microfilms Order No. 8108122

Depth distributions of the radiation damage in moderately to heavily ion bombarded silicon were obtained in the following manner. The electron spin resonance signal from an ion bombarded silicon target was measured. This Electron Spin Resonance (ESR) signal was proportional to the amount of amorphous silicon present in the target. A thin oxide of specified thickness was then grown on the surface of the target by anodic oxidation, and subsequently stripped off in a HF etch. The dept of the stripped impression below the unoxidized surface was measured using a multibeam interferometer. The amorphous ESR signal was again measured, and the strip/measure process was continued until the total implanted layer was removed. It was also possible to deduce the energy deposited into atomic processes (damage) per incident ion from the amorphous ESR signal at the critical dose, corrected to include the nonamorphous damage. To determine this energy, a procedure for calibrating the experimental results to the theoretical results was chosen. Results indicate that the theoretical calculations greatly overestimated the energy deposited into damage for light incident ions. Dissert. Abstr.

N81-22945 Ohio State Univ., Columbus.
THE CHARGED POINT DEFECT IN CLASSICAL FLUIDS Ph.D. Thesis
Dah-Yang Kuan 1980 127 p
Avail: Univ. Microfilms Order No. 8107355

Localized excess electron states are investigated using a density functional formalism previously developed for nonuniform classical fluids. The electron atom interactions used include the short range effective core potential and a long range polarization potential. The interatomic interaction is the Lennard-Jones (6-12). potential. Some results are in agreement with previous density functional calculations which use a simple contact potential for the electron atom interaction in that no localized states are found in dilute helium and neon gases, while localized states are found in dense helium gas and in liquid neon close to the liquid gas coexistence curve. The calculations disagree with the earlier ones in that they predict the localized states in liquid neon are stable even at pressures much larger than the saturated vapor pressure. Atomic clustering around potassium ion impurities in argon gas was also investigated. At room temperature and for sufficiently small gas densities, the results are in good agreement with computer simulations. Dissert. Abstr.

N81-22946 Ohio State Univ., Columbus.
THERMOELECTRICALLY GENERATED CHARGE UNBALANCE IN SUPERCONDUCTING ALUMINUM FILMS Ph.D. Thesis
David Frank Heidel 1980 66 p
Avail: Univ. Microfilms Order No. 8107338

Voltages were measured in seven aluminum film samples including two samples containing the magnetic impurity Er. The results obtained from the Al samples support recent theoretical predictions that a quasiparticle charge imbalance distribution is produced in a current carrying superconductor by a temperature gradient. In samples with no magnetic impurities, the observed linear dependence of the charge imbalance voltage on both the current and the temperature gradient as well as a divergence of

the voltage near the superconducting transition temperature are in qualitative agreement with theory. In the two samples which contained magnetic impurities, the voltage was also observed to have a linear dependence on the current. This result does not support the prediction that the charge imbalance voltage should have a non linear current dependence in the presence of these impurities. Dissert. Abstr.

N81-22947 Pennsylvania State Univ., University Park.
THEORY OF PHOTOSTIMULATED FIELD EMISSION Ph.D. Thesis
Carey Schwartz 1980 138 p
Avail: Univ. Microfilms Order No. 8107632

A theory of photostimulated field emission is developed and its predictions are compared to experimental data. The theory is found to be in qualitative agreement with the experimental data. However, the theory does not yield all the features of the experimental data. The theory is based upon an adaptation of an earlier theory of photoemission, and is applied to several models of the surface potential barrier. Additionally, a second theory of photostimulated field emission is formulated. This theory is based upon an adaptation of the kinetic theory of field emission. It is shown that this theory is equivalent to the previous theory if the matrix element describing the absorption process is a weak function of the initial electronic energy. Both theories predict that the total photostimulated field emission current is extremely sensitive to form the surface potential. It is found that a key ingredient of both theories is the transmission coefficient of the surface barrier. The traditional WKB transmission coefficient is found to be inadequate to describe the tunneling of the photoexcited electrons. Dissert. Abstr.

N81-22948 Pennsylvania State Univ., University Park.
THE BEHAVIOR OF ELECTRONS INTERACTING WITH ACOUSTIC MODE PHONONS VIA THE DEFORMATION POTENTIAL Ph.D. Thesis
George Bernard Norris 1980 165 p
Avail: Univ. Microfilms Order No. 8107617

Several aspects of the acoustic deformation potential polaron are examined to give a better understanding of its behavior as a function of coupling strength and velocity. A theory which interpolates between the limits of weak and strong coupling is considered. Although this theory smoothly interpolates between weak and strong coupling results for increasing coupling strength and velocity in one dimension, in three dimensions a discontinuous transition between the coupling extremes is predicted. This is interpreted as additional evidence that a self trapping transition occurs in three dimensions. It is also noted that the anomalously localized strong coupling theory involves anharmonically large lattice dilations. A theory which includes the anharmonic lattice potential is developed and an internally self consistent strong coupling state with increased indices is found to exist for an intermediate range of coupling strengths. However, the energy momentum relation of this theory exhibits the same unphysical behavior seen in one of the weak coupling theories. Dissert. Abstr.

N81-22949 Pennsylvania Univ., Philadelphia.
STATISTICAL MECHANICS OF LIPID BILAYERS Ph.D. Thesis
Mark Menniti Stecker 1980 296 p
Avail: Univ. Microfilms Order No. 8107806

A statistical mechanical description of the main lipid bilayer phase transition is presented in which the degrees of freedom associated with the hydrocarbon chains of the phospholipid molecules are of primary importance. (The head groups do certainly play a significant role in determining the properties of this phase transition but their role is essentially a passive one.) Specifically, a model is developed in which, the chains are very highly ordered (i.e., essentially in the all-trans state) in the low temperature phase and disordered (i.e., a significant number of carbon-carbon bonds are in gauche configurations) in the high temperature phase. Dissert. Abstr.

N81-22950 Pennsylvania Univ., Philadelphia.
EXPERIMENTAL STUDIES OF ELECTRO-OPTIC AND FERROELECTRIC PHENOMENA IN ORGANIC SOLIDS Ph.D. Thesis
George Ferris Lipscomb 1980 221 p
Avail: Univ. Microfilms Order No. 8107772

The exceptional non-linear optical properties exhibited by certain organic materials are considered with emphasis on asymmetric substituted benzene derivatives. The low frequency linear electro-optic effect in crystals of 2-methyl-4-nitroaniline (MNA) was measured for two different modulation configurations. One orientation was found to exhibit an exceptionally large figure of merit for electro-optic phase retardation, comparable to that found in lithium niobate. The crystal structure and morphology of MNA crystals are described. One symmetric nitrophenoxy disubstituted diacetylene, 1,6-bis(2,4-nitrophenoxy)-2,4-hexadiyne, DNP (1), was used to study the conditions for solid state polymerization and the structural changes during polymerization. The kinetics of the solid state polymerization reaction were examined using differential scanning calorimetry. A transition from a high temperature nonpolar state to a low temperature polar state, in which second order nonlinear optical effects are allowed, was observed at 31 K along with an anomaly in the dielectric constant. The transition is analyzed. Dissert. Abstr.

N81-22951*# National Aeronautics and Space Administration, Washington, D. C.
METHOD FOR HORIZONTALLY GROWING RIBBON CRYSTAL
Bossi Kudo Jun. 1980 14 p Transl. into ENGLISH from Japanese Patent No. Sho 52-15485 (Appl. No. 50-91099, 5 Jul. 1975) p 437-441 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prepared by Toyo Silicone Co., Ltd., Tokyo
(Contract NASw-3199)
(NASA-TM-75809) Avail: NTIS HC A02/MF A01 CSCL 20B

A high speed method for forming ribbon crystal of desired width and thickness is characterized by drawing out the ribbon through a space whose distance is 5.7 times that of the thickness of the grown ribbon. The ribbon is drawn out between the molten body of the lower surface and the tip of the upper surface of the seed crystal and growing crystal. The ribbon growing at the tip of the seed crystal is drawn out horizontally and centrifugally by controlling the amount of cooling and heating. The temperature is maintained about equal to the upper surface of the outlets from which the molten substance is drawn, at least in certain portions of the crucible rim, the rim is elevated to prevent dropping of the molten raw material. A.R.H.

N81-22952# Materials Research Labs., Ascot Vale (Australia).
THE EFFECT OF CRYSTAL ORIENTATION ON GROWTH ON POLYCRYSTALLINE TNT
William S. Wilson May 1980 22 p refs
(AD-A096591; MRL-R-775 AR-002-156) Avail: NTIS HC A02/MF A01 CSCL 20/2

Dimensional instability of polycrystalline TNT depends markedly on crystal orientation within the specimen. Growth or irreversible expansion on thermal cycling is large in a particular direction if there is a 'texture' of crystals with high and low coefficients of thermal expansion in that direction which interact to produce large intercrystalline stresses. Growth is smaller when the crystals are so arranged that there are no such interactions and the intercrystalline stresses generated in that direction are small. Creamed TNT with its random crystal orientation generates equal intercrystalline stresses in all directions on thermal cycling, and growth is consequently equal in all directions. These results are consistent with the 'ratchet' mechanism proposed previously to account for growth in polycrystalline TNT. GRA

N81-22953# Oxford Univ. (England). Chemical Crystallography Lab.
MAGNETIC ORDERING IN OXIDE SOLID SOLUTIONS Interim Scientific Report, 1 Sep. 1979 - 31 Aug. 1980
A. K. Cheetham 13 Mar. 1981 7 p refs
(Grant AF-AFOSR-0120-79; AF Proj. 2301)
(AD-A096886; EOARD-TR-81-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Measurements were completed on NiO-CoO and MnO-CoO, and preliminary studies done in the systems NiO-MnO, Feo-MnO/ and FeO-CoO. Each system was examined changes of spin direction and crystal symmetry as a function of temperature

and pressure in the antiferromagnetic phases. The results suggest that the strength of the magnetic anisotropy associated with the metal ions falls in the sequence Co(2+) = Mn(2+) = Fe(2+) approx Ni(2+). DOE

N81-22954# Chicago Univ., Ill.
ELECTRON IMPACT DESORPTION OF Xe FROM THE TUNGSTEN (110) PLANE
Q. J. Zhang and R. Gomer Mar. 1981 16 p refs
(Contract N00014-77-C-0018)
(AD-A096910; Rept-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

The electron stimulated desorption of Xe on the clean and on oxygen and CO covered tungsten (110) surfaces has been investigated. Only neutral Xe desorption was observed; a very small initial regime with cross section 10 to the minus 17th power sq. cm. is followed by a slow decay with cross section 3 x 10 to the minus 19th power sq. cm. The Xe yield varies nonlinearly with coverage, suggesting desorption from edges of islands or from sites with less than their full complement of nearest neighbor Xe atoms. Desorption from oxygen or CO covered surfaces results in an apparent desorption cross section identical to that of the underlying adsorbate. This results from a kicking off of Xe by electron desorbed O or CO. The true cross sections for these processes are approx. 10 to the minus 14th power sq. cm. for Xe-O and approx. 10 to the minus 15th power sq. cm. for Xe-CO. Some speculations about the mechanism, particularly the absence of ions are presented. GRA

N81-22955# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
A SIMPLE METHOD FOR LOCATION OF THE MOUNTING POSITIONS FOR ACCELERATION SENSITIVITY SC-CUT RESONATORS
John C. Gualtieri Feb. 1981 14 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A097001; DELET-TR-81-5) Avail: NTIS HC A02/MF A01 CSCL 20/2

The acceleration sensitivity of SC-cut crystal resonators is an important consideration with regard to modern communications, navigation and identification systems. This report describes a simple method for the location of the mounting positions for a three-point support configuration. Crystallographic directions are related to piezoelectric measurements and polar etching results. A conoscopic method is then used to locate the support positions. GRA

N81-22956# Hughes Research Labs., Malibu, Calif.
GaAs SURFACE PASSIVATION FOR DEVICE APPLICATIONS Interim Report, 15 Jun. - 14 Dec. 1979
C. L. Anderson and M. D. Clark Wright-Patterson AFB, Ohio AFWAL Oct. 1980 19 p
(Contract F33615-78-C-1444; AF Proj. 2305)
(AD-A096781; AFWAL-TR-80-1149) Avail: NTIS HC A02/MF A01 CSCL 09/1

This report describes the progress in the second six-month period of a program to develop deposited dielectrics for GaAs device applications. Three applications of the dielectrics are being investigated: (1) isolation of control electrodes, (2) passivation of the GaAs surface, and (3) encapsulation of completed circuits. The dielectrics being studied include silicon oxynitride; mixtures of silicon nitride and germanium nitride; and mixtures of silicon dioxide, gallium oxide, and aluminum oxide. During this reporting period, studies of the interface properties of pyrolytically deposited Si3N4 on n-type GaAs under illuminated conditions were performed. The data obtained are consistent with the interpretation that inversion of the GaAs surface is being achieved. In addition, process parameters for plasma-enhanced deposition of silicon nitride films with low oxygen content and refractive index near that of stoichiometric Si3N4 were determined. Evaluation of the interface properties of SiO2 films deposited on GaAs by photochemical deposition is also reported. GRA

N81-22957# Cornell Univ., Ithaca, N. Y.
DEFECTS IN METAL CRYSTALS Progress Report, 1 May 1980 - 30 Apr. 1981
David N. Seidman Jan. 1981 102 p refs
(Contract DE-AS02-76ER-03158)
(DOE/ER-03518/96) Avail: NTIS HC A06/MF A01

Atomic mechanisms for the formation of metal silicides, produced as a result of ion or electron irradiation of metal-silicon sandwiches, and the ion irradiation of subsaturated binary alloys containing silicon were investigated. The mechanisms responsible for radiation induced segregation and RIP in a wide range of fast neutron irradiated refractory metals and alloys were also studied. In these same neutron irradiated specimens a search is being made for the species that are responsible for the nucleation of voids. In particular, the voids are being examined, by the atom probe field ion microscope technique, for the interstitial impurities helium, carbon, nitrogen and oxygen. Evidence was obtained for the presence of carbon in a void of a fast neutron irradiation molybdenum (titanium) alloy. DOE

N81-22958# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.
MICROSTRUCTURAL EFFECTS IN ABRASIVE WEAR Quarterly Progress Report, 1 Sep. - 1 Dec. 1980
N. F. Fiore, T. H. Kosel, C. Rao, V. Desai, and H. R. Shetty 3 Feb. 1981 65 p refs
(Contract DE-AS02-77ET-10460)
(DOE/ET-10460/15) Avail: NTIS HC A04/MF A01

Quantitative relationships between microstructure and wear resistance of highly alloyed materials were examined. High-Cr white irons and experimental Co-base and Ni-base powder metallurgy (PM) alloys now used or potentially to be used in coal mining handling, and gasification were included. The specific types of wear studied were low-stress abrasion and gouging wear encountered in mining, coal conversion, and transfer applications. Abrasion in multiphase alloys was also studied. DOE

N81-22959# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
INVESTIGATION OF DEEP LEVEL DEFECTS IN EPITAXIAL SEMICONDUCTING ZINC SULPHO-SELENIDE Progress Report, 15 Jun. 1980 - 14 Jun. 1981
B. W. Wessels 15 Feb. 1981 38 p refs
(Contract DE-AC02-79ER-10390)
(DOE/ER-10390/2) Avail: NTIS HC A03/MF A01

High conductivity ZnSe single crystalline films were heteroepitaxilly deposited on GaAs substrates using open tube chemical vapor transport. Unintentionally doped films had net donor densities of 10(14) - 10(16) cm(+3) and resistivities of 1 to 10(3) ohm cm. Resistivity was found to be strongly dependent upon zinc partial pressure during deposition. Electron mobilities of the order of 50 to 200 cm(2)/V sec were observed which suggested that the films are highly compensated. Properties of the deep level defects in heteroepitaxially grown ZnSe were investigated using transient capacitance spectroscopy. A series of electron traps were observed with activation energies of 0.33, 0.35, 0.42, 0.71 and 0.86 eV in Au/ZnSe Schottky diodes. Trap concentration ranged from 10(12) to 10(14) cm(+3) and depended on the zinc partial pressure. A model for the defect structure of ZnSe was proposed. Growth studies of ZnS/sub x/Se/sub 1-x/ on GaAs were begun. DOE

N81-22960# Purdue Univ., Lafayette, Ind.
STUDY OF ELECTRONS PHOTOEMITTED FROM FIELD-EMISSION TIPS Progress Report, 1 Jul. 1980 - 1 Jan. 1981
R. Reifenberger Jan. 1981 17 p refs
(Contract DE-AS02-79ER-10464)
(DOE/ER-10464/2) Avail: NTIS HC A02/MF A01

Photo induced field emission, a technique which studies electrons which have been photoemitted from a field emission tip is discussed. This method combines the proven utility of both field emission and photoemission for investigating the electronic states near a metal surface. Photo induced field emitted electrons using a tunable cw dye laser were investigated. To fully exploit this continuously tuneable photon source, a differential energy analyzer was constructed to allow energy resolved measurements of the photo field emitted electrons. Progress in implementing experiments on photo-induced field emission is reported. DOE

N81-22961# California Univ., Livermore. Lawrence Livermore Lab.
BRILLOUIN BACKSCATTER MODEL IN LASNEX: IMPROVEMENTS AND ADDITIONS
Judith Harte and Kent Estabrook 17 Jun. 1980 11 p refs
(Contract W-7405-eng-48)
(UCID-18711) Avail: NTIS HC A02/MF A01

In the 1978 Annual Report, a stimulated Brillouin scatter (SBS) model for LASNEX was described. Many improvements and additions were made in 1979 in order to model the Brillouin backscatter in underdense plasmas more accurately. The density dependence of the model was changed and the effects of inhomogeneous media were included. A self consistent calculation of the hot ion contribution to the ion damping was added and the saturation calculation and calculation of backscatter when a very small fraction is reflected were improved. Finally, the treatment of the backscattered light was considerably expanded. These changes to the SBS model are described. DOE

N81-22962# California Univ., Livermore. Lawrence Livermore Lab.
CALCULATIONS OF STIMULATED BRILLOUIN SCATTER WITH LASNEX
K. Estabrook and J. Harte 17 Jun. 1980 6 p refs
(Contract W-7405-eng-48)
(UCID-18713) Avail: NTIS HC A02/MF A01

A model was developed that predicts the fraction of light absorbed by gold disks over a wide range of intensities and factor of 2 in laser wavelength. A figure shows LASNEX predictions for absorption and Brillouin reflection for 1 ns laser light from 0.25 to 4.0 (SIGMA) m wavelength and intensities varying from 3 x 10 to the 13th power to 3 x 10 to the 16th power. DOE

N81-22963# Battelle Pacific Northwest Labs., Richland, Wash.
SOLID STATE STORAGE OF RADIOACTIVE KRYPTON IN A SILICA MATRIX
G. L. Tingey, J. M. Lytle, W. J. Gray, and K. R. Wheeler Dec. 1980 25 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3617) Avail: NTIS HC A02/MF A01

The feasibility of loading a low density SiO2 glass with krypton for storage of radioactive Kr-85 was demonstrated by studies using non-radioactive krypton. A 96% SiO2 glass with 28% porosity was heated at an elevated pressure of Kr gas to a temperature of 850 C to 900 C and held at that temperature to sinter the glass-krypton composite to a density of about 2 g cu cm. A krypton content of 30 of Kr(STP) cu cm of glass was demonstrated when loading pressures of 140 MPa are used. Krypton release rates from the glass are lower than reported for any other waste form considered currently. At 420 C, a diffusion parameter of 8.66 x 10 to the 13th power/min was determined which leads to a total release of 0.7% of the krypton in 10 years. Release rates increase moderately with increasing temperature up to 600 C and increase rapidly above 600 C. DOE

N81-22964# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelement.
PRODUCTION TECHNOLOGY FOR VARIABLE HUE GaP LIGHT EMITTING DIODES Final Report
Joerg Aengenheister, Siegfried Leibenzeder, and Hans-Eberhard Bergt Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 79 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-021; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

A single GaP crystal chip which emits red and green light, generated by two separate p-n junctions, was fabricated and used in the development of a variable hue LED. The driving of both p-n junctions to obtain varying hues between red and green is explained. The p-n junctions were deposited by liquid phase epitaxy. The epitaxial process is depicted and characterized first for the red end, then for the green end of the diode. The dependence of quantum efficiency on doping (Zn) concentration is discussed. Effects of changing the order in which the epitaxial layers are deposited (green then red; red then green) are shown. The color characteristics of the optimized multihue LED are given. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N81-22965*# Maryland Univ., College Park. Inst. for Physical Science and Technology.
REPRESENTATIVE EQUATIONS FOR THE THERMODYNAMIC AND TRANSPORT PROPERTIES OF FLUIDS NEAR THE GAS-LIQUID CRITICAL POINT Final Report
J. V. Sengers, R. S. Basu, and J. M. H. Levelt Sengers (NBS) Washington NASA May 1981 60 p refs
(Grant NGR-21-002-344)
(NASA-CR-3424) Avail: NTIS HC A04/MF A01 CSCL 20M

A survey is presented of representative equations for various thermophysical properties of fluids in the critical region. Representative equations for the transport properties are included. Semi-empirical modifications of the theoretically predicted asymtotic critical behavior that yield simple and practical representations of the fluid properties in the critical region are emphasized. J.M.S.

N81-22966# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
RESEARCH IN THEORETICAL PHYSICS Annual Report, 1 Apr. 1980 - 31 Mar. 1981
Dec. 1980 41 p refs
(Contract DE-AC02-76ER-03285)
(DOE/ER-03285/38; JHU-HET-8007) Avail: NTIS HC A03/MF A01

Nonperturbative QCD at finite temperatures and on minimal subconstituent models of quarks and leptons is considered. The transition from weak to strong coupling in QCD is assumed to be accompanied by a phase transition in bulk hadronic matter observed in fireballs formed in central collisions of heavy nuclei. The phase of the hadronic matter can perhaps be probed through leptonic reaction channels. A simplified theory of the evolution of the fireball was developed. The main result is that just below a phase transition, increased fluctuations should give rise to increased radiation of direct photons, whereas above the phase transition, quark pairs annihilating into lepton pairs give a characteristic signature in that channel. The group structure of some minimal subconstituent models of quarks and leptons was analyzed. The Lorentz structure of the subconstituents affects substantially the spectrum of such models. Within the framework of field theory, two no go theorems can be proved. DOE

N81-22967# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique.
THERMODYNAMICS, GENERAL COVARIANCE AND MATERIAL FRAME INDIFFERENCE
P. Iglesias Nov. 1979 20 p refs
(CNRS-CPT-79-P-1147) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

A geometrical thermodynamic model of dissipative matter in general relativity is proposed. A method is given to select the invariant variables under the action of the diffeomorphisms, upon which this model must depend. The general expression for the energy momentum tensor and for the covector entropy is given. It is established that these variables are meaningful for the construction of a predictive model of dissipative continuous medium. Therefore, the principle of invariance (under the action of the diffeomorphisms), taken from the general relativity, appears like an unambiguous mathematical formulation of the principle of objectivity used in the classical formulation of the mechanics of continuous medium. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N81-22968*# National Aeronautics and Space Administration, Washington, D. C.

NASA'S UNIVERSITY PROGRAM ACTIVE PROJECTS. FISCAL YEAR 1980
1980 325 p
(NASA-TM-82387) Avail: NTIS HC A14/MF A01 CSCL 05A

Data on projects active during fiscal year 1980 are organized alphabetically by state. The appendix includes a cross-reference indexed by field of science and engineering. S.F.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-22969*# National Academy of Sciences - National Research Council, Washington, D. C.
NASA'S AERONAUTICS RESEARCH AND TECHNOLOGY BASE Final Report
Apr. 1979 52 p
(Contract NASw-2342)
(NASA-CR-164195; PB81-134686) Avail: NTIS HC A04/MF A01 CSCL 05A

NASA's research technology base in aeronautics is assessed in terms of: (1) US aeronautical technology needs and requirements in the future; (2) objectives of the aeronautics program; (3) magnitude and scope of the program; and (4) research and technology performed by NASA and other research organizations. S.F.

N81-22970# Decisions and Designs, Inc., McLean, Va.
ISSUES IN THE DESIGN AND EVALUATION OF DECISION-ANALYTIC AIDS
Leonard Adelman, Michael Donnell, L., John E. Patterson, and Jonathan J. Weiss Feb. 1981 74 p refs
(Contract MDA903-80-C-0194; DARPA Order 3831)
(AD-A096893; TR-81-1-304) Avail: NTIS HC A04/MF A01 CSCL 12/2

During recent years, decision analysis has emerged as a highly valuable technology for allowing decision makers to formulate important problems in a logical framework, incorporating factual as well as judgmental information to arrive at a consistent, realistic solution. Computers have served well as aids to calculation, display, editing, and memory functions. On the basis of previous success, organizations are beginning to develop computer-based decision-analytic aids with stand-alone capabilities for routine use by internal analysts and decision makers without outside consultation. Decision-analytic aids include different types of multi-attribute utility assessment models and traditional decision-theoretic tree models requiring probability and utility assessments. Although some stand-alone decision-analytic aids have been quite successful, others have not been utilized by their prospective users. The purpose of this report is to provide guidelines for the effective design, implementation, and evaluation of such decision aids. A framework for considering issues relevant to the design and evaluation of decision-analytic aids is presented in the introduction. This framework identifies three interfaces essential for the effective integration of decision aids into organizations. This first interface is between the decision aid and the user; here, the issue is the extent to which characteristics of the aid facilitate or hinder its usability. GRA

N81-22971# Boeing Co., Seattle, Wash. Product Support/ Experience Analysis Center.
DEVELOPMENT OF MAINTENANCE METRICS TO FORECAST RESOURCE DEMANDS OF WEAPON SYSTEMS. ANALYSIS AND EVALUATION, REVISION A Interim Report, 1 Mar. 1978 - 15 Oct. 1979
Donald K. Hindes, Gary A. Walker, David H. Wilson, and Frank Maher (AF Human Resources Lab., Wright-Patterson AFB, Ohio) Feb. 1980 156 p refs Revised
(Contract F33615-77-C-0075)
(AD-A096688; D194-10089-1) Avail: NTIS HC A08/MF A01 CSCL 05/1

This report describes the results of the first four tasks of an eight task study. The total effort is intended to develop more accurate metrics and weightings to be incorporated into the Air Force method (Logistics Composite Model (LCOM)) for determining manpower and other resource requirements for operational and developing weapon systems. The approach taken for this portion of the study effort was to identify, obtain, review and catalog related research and/or descriptive studies; select a representative cross section of aircraft and subsystems/equipments; identify and select applicable study parameters/variables; and acquire field experience data from various maintenance management information systems and on-site visits to operational units. The data base thus accumulated was computer processed via LCOM criteria in preparation for follow-on analysis. GRA

N81-22972# Boeing Co., Seattle, Wash. Product Support/ Experience Analysis Center.
DEVELOPMENT OF MAINTENANCE METRICS TO FORECAST RESOURCE DEMANDS OF WEAPON SYSTEM. MAINTENANCE METRICS AND WEIGHTINGS, REVISION A Interim Report, 1 Nov. 1978 - 1 Oct. 1979
Donald K. Hindes, Gary A. Walker, David H. Wilson, and Frank Maher (AF Human Resources Lab., Wright-Patterson AFB) Oct. 1980 383 p refs Revised
(Contract F33615-77-C-0075)
(AD-A096689; D194-10089-3) Avail: NTIS HC A17/MF A01 CSCL 05/1

The approach taken for this portion of the study effort was to utilize the source data identified in Task V as inputs to develop statistical models for the estimation and prediction of the maintenance action demands of the equipment items selected for study. The data case values acquired for the lists of hardware, operational parameters which were found in Task V (Analyzing and Prioritizing Parameters) to be directly and strongly related to the maintenance demand rates of the selected equipment items were reconstituted into input data sets for the modeling process. This process resulted in one hardware, one operational, and one environmental data set being associated with each aircraft subsystem studied. Step-wise regression analysis was then applied to each data set for each subsystem's equipment to obtain best fit multiple regression equations explaining maintenance action demand as a function of equipment characteristic parameters, as a function of operational characteristic parameters, and as a function of environmental characteristic parameters. These separate equations for each type of parameter consitute 'generic' Maintenance Metrics and Weightings Models which facilitate the estimation of expected maintenance action demand for any aircraft subsystem when only equipment characteristics, only operational characteristics, or only environmental characteristics are known. GRA

N81-22973# Boeing Co., Seattle, Wash. Product Support/ Experience Analysis Center.
DEVELOPMENT OF MAINTENANCE METRICS TO FORECAST RESOURCE DEMANDS OF WEAPON SYSTEMS. ANALYSIS AND RESULTS OF METRICS AND WEIGHTINGS, REVISION A Interim Report, 1 Nov. 1978 - 1 Oct. 1979
Donald K. Hindes, Gary A. Walker, David H. Wilson, and Frank Maher (AF Human Resources Lab., Wright-Patterson, AFB, Ohio) Nov. 1980 164 p refs Revised
(Contract F33615-77-C-0075)
(AD-A096690; D194-10089-4) Avail: NTIS HC A08/MF A01 CSCL 05/1

This report describes the method and results of the eighth task to Develop Maintenance Metrics to Forecast Resource Demands of Weapon Systems. The purpose of this task was to perform simulation experiments with existing LCOM aircraft simulators using the newly developed maintenance metrics and weightings in order to validate the techniques and data developed during the course of this study. The findings indicate that the new maintenance metrics predictor equations can provide acceptable estimations of overall aircraft maintenance demand rates under a wide variety of equipment, operational, and environmental characteristics. These general models could be used for predicting equipment failure rates in many user situations such as LCOM analyses and new aircraft concept definition. GRA

N81-22974# Arinc Research Corp., Annapolis, Md.
AIRCRAFT MODIFICATION MANAGEMENT EVALUATION Final Report
S. Baily Dec. 1980 115 p refs
(Contract F33615-80-C-5102)
(AD-A096458) Avail: NTIS HC A06/MF A01 CSCL 05/1

Because of the long lead times and large budgetary outlays associated with major weapon system acquisitions, it is planned that most of the current inventory of US Air Force aircraft types will remain in service through the 1990s. As a result of this continued use of existing aircraft, the Air Force must pursue an aggressive modernization program to maintain the force structure at a high level of operational readiness. Rapidly expanding technology is being exploited to maintain a high degree of capability in an aging force. These factors are expected to result in an extensive aircraft retrofit program at least through the year 2000. To ensure the smooth implementation of this modification effort for aircraft weapon systems, the Air Force must continue to improve modification management techniques. Fundamental problem areas exist in current Air Force management techniques for aircraft modification. Therefore, this analysis was undertaken (1) to identify, define, and validate the most significant problem areas in aircraft modification management; (2) to examine the cause-and-effect relationship of identified problems and develop a structured approach to their resolution; and (3) to identify topics requiring research and initiatives leading to improvement in aircraft modification management. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-22975*# BioTechnology, Inc., Falls Church, Va.
PROTOTYPE INPUT AND OUTPUT DATA ELEMENTS FOR THE OCCUPATIONAL HEALTH AND SAFETY INFORMATION SYSTEM Final Report
Adrienne A. Whyte Nov. 1980 116 p refs
(Contract NASw-3119)
(NASA-CR-164208) Avail: NTIS HC A06/MF A01 CSCL 05B

The National Aeronautics and Space Administration plans to implement a NASA-wide computerized information system for occupational health and safety. The system is necessary to administer the occupational health and safety programs and to meet the legal and regulatory reporting, recordkeeping, and surveillance requirements. Some of the potential data elements that NASA will require as input and output for the new occupational health and safety information system are illustrated. The data elements are shown on sample forms that have been compiled from various sources, including NASA Centers and industry. S.F.

N81-22976*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A REVIEW AND EVALUATION OF THE LANGLEY RESEARCH CENTER'S SCIENTIFIC AND TECHNICAL INFORMATION PROGRAM. RESULTS OF PHASE 4: KNOWLEDGE AND ATTITUDES SURVEY, ACADEMIC AND INDUSTRIAL PERSONNEL Final Report
Thomas E. Pinelli, Myron Glassman (Old Dominion Univ.), and Nanci A. Glassman (Continental Research, Norfolk, Va.) Feb. 1981 61 p refs
(NASA-TM-81934) Avail: NTIS HC A04/MF A01 CSCL 05B

Feedback from engineers and scientists in the academic and industrial community provided an assessment of the usage and perceived quality of NASA Langley generated STI and the familiarity and usage of selected NASA publications and services and identified ways to increase the accessibility of Langley STI. The questionnaire utilized both open and closed ended questions and was pretested for finalization. The questions were organized around the seven objectives for Phase IV. From a contact list of nearly 1,200 active industrial and academic researchers, approximately 600 addresses were verified. The 497 persons who agreed to participate were mailed questionnaires. The 381 completed questionnaires received by the cutoff date were analyzed. Based on the survey findings, recommendations were made for increasing the familiarity with and use of NASA and Langley STI and selected NASA publications and services. In addition, recommendations were made for increasing the accessibility of Langley STI. A.R.H.

N81-22977# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
METHODOLOGICAL CONSIDERATIONS IN THE DESIGN OF LARGE SCALE SYSTEMS ENGINEERING PROCESSES
Andrew P. Sage 1 Feb. 1981 75 p refs
(Contract N00014-80-C-0542; NR Proj. 197-065)
(AD-A096872; UVA/SE-81-4) Avail: NTIS HC A04/MF A01 CSCL 12/2

This paper discusses some methodological considerations in the design of large scale systems engineering processes. We begin our effort by providing several definitions of system engineering. There are a number of impediments to the resolution of large scale issues in the public and private sectors and it is important that designers of appropriate and useful systems be aware of these. Following a discussion of these impediments, we present a structure describing the systems engineering process. This is used to motivate discussion of the functional considerations involved in a systemic process: systems science and operations research, systems methodology and design, and systems management. A brief discussion of methods for formulation, analysis an interpretation is followed by a discussion of systems management and the associated use of human judgement for the design of systemic processes. We believe the contingency task structure of systems management to be an especially useful guideline for the design of information systems for planning and decision support. We give a number of reasons supporting this belief and present a model for information aquisition and information evaluation based on our contingency task structure. A discussion of systems engineering in the political process and implications for professional practice is followed by delineation of the many potential benefits of the systems process. GRA

N81-22978# Idaho National Engineering Lab., Idaho Falls.
ISDMS (RELEASE 1.1): A SCIENTIFIC DATA MANAGEMENT SYSTEM
H. R. Bruestle, K. D. Russell, D. M. Snider, and H. D. Stewart Nov. 1980 887 p refs
(Contract DE-AC07-76ID-01570)
(EGG-IS-5287) Avail: NTIS HC A99/MF A01

Included are the following: ISDMS historical background, design philosophy; system description, and reference section. The following packages are described in detail: ISDMS environmental library (a collection of relocatable routines), MASTER (interactive/batch executive program), MAGNUM (interactive graphics program), QKPLT (batch graphics program), POST (general plot file post processor program), FILTER (general digital filter program), COMEDIT (alphanumeric editing program), SEARCH (CWAF file directory and retrieval program), BACKUP/RESTORE (CWAF backup and restore program), MUX/DEMUX (general data multiplexor/demultiplexor programs), EXPERT (general file manipulation program), WIZARD (general computed parameter program), MERGE (data file copy/merge program), COMSID (CWAF to SIDU reformating program), REFORM (general data reformatting program), and RELCOM (RELAP4 to CWAF data reformating program). Dissert. Abstr.

N81-22979# Kansas Univ., Lawrence. Museum of Natural History.
DEVELOPMENT OF A CENTER FOR BIOSYSTEMATICS RESOURCES Summary Report, 1 Nov. 1979 - 31 Oct. 1980
Stephen R. Edwards Nov. 1980 9 p
(Contract DE-AC02-79EV-10026)
(DOE/EV-10026/2) Avail: NTIS HC A02/MF A01

A Center for Biosystematics Resources is developed to provide a centralized source of information regarding the biological

expertise available in the academic/museum community; and the federal and state regulations concerning the acquisition, transport, and possession of biological specimens. The heart of the Center is a series of computer assisted data bases which contain information on bilogists and their areas of expertise, biological collections, annotated federal regulations, and federal and state controlled species lists. The purpose of this three year contract with the Department of Energy is to continue the updating and revision of the original data bases, make the information they contain readily available to the Department of Energy, other government agencies, the private sector, and the academic community; and to achieve financial independence by the end of the three year period. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-22980*# National Aeronautics and Space Administration, Washington, D. C.
CONTRIBUTION OF CORRESPONDING MEMBER OF THE USSR ACADEMY OF SCIENCES YE. A. KOROVIN TO THE SCIENCE OF INTERNATIONAL SPACE LAW. ANNIVERSARY OF CORRESPONDING MEMBER OF THE USSR ACADEMY OF SCIENCES, PROFESSOR YE. A. KOROVIN
G. P. Zhukov Sep. 1980 8 p Transl. into ENGLISH of "Vklad chlena-korrespondenta AN SSSR Ye. A. Korovina v nauku mezhdunarodnogo kosmicheskogo prava" (unpublished manuscript) Moscow, 1980 4 p and Vestn. Mosk. Univ. (USSR), no. 4, 1962 p 77-78 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76363) Avail: NTIS HC A02/MF A01 CSCL 05D

The Soviet Union's participation in the solution of international legal problems as space flights became possible is reviewed with emphasis on the efforts of the most prominent Soviet international lawyer. Some of the professor's 230 writings are highlighted. A.R.H.

N81-22981# PRC Energy Analysis Co., Los Angeles, Calif.
DETERMINANTS OF A STRATEGY FOR INTERNATIONAL PARTICIPATION IN AN SPS PROGRAM
Alan P. Daurio Dec. 1980 53 p refs
(Contract DE-AC01-79ER-10041)
(DOE/ER-10041/T14) Avail: NTIS HC A04/MF A01

Factors involved in developing a strategy of widespread international participation in the Solar Power Satellite System are surveyed. Western industrialized countries and developing nations are included. Emphasis is placed on US recognition of the technical and institutional barriers to foreign participation, such as rectenna land requirements and the limitations on the sharing of technology and manufacturing responsibilities. Other factors reviewed include: (1) geographical and siting problems; (2) electricity supply and demand forecasts; (3) orbital limitations, due to the number of nations making claims to the GEO orbit segment; (4) organizational problems affecting European involvement in any research and development and commercialization effort; and (5) industrial capacity. J.M.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-22982*# Ford Motor Co., Dearborn, Mich.
CERAMIC REGENERATOR SYSTEMS DEVELOPMENT PROGRAM Final Report, 1 Oct. 1976 - 31 Dec. 1979
C. A. Fucinari, C. J. Rahnke, V. D. N. Rao, and J. K. Vallance Oct. 1980 264 p refs Sponsored in part by DOE
(DEN3-8)
(NASA-CR-165139; DOE/NASA/0008-12) Avail: NTIS HC A12/MF A01 CSCL 10B

The DOE/NASA Ceramic Regenerator Design and Reliability Program aims to develop ceramic regenerator cores that can be used in passenger car and industrial/truck gas turbine engines. The major cause of failure of early gas turbine regenerators was found to be chemical attack of the ceramic material. Improved materials and design concepts aimed at reducing or eliminating chemical attack were placed on durability test in Ford 707 industrial gas turbine engines late in 1974. Results of 53,065 hours of turbine engine durability testing are described. Two materials, aluminum silicate and magnesium aluminum silicate, show promise. Five aluminum silicate cores attained the durability objective of 10,000 hours at 800 C (1472 F). Another aluminum silicate core shows minimal evidence of chemical attack after 8071 hours at 982 C (1800 F). Results obtained in ceramic material screening tests, aerothermodynamic performance tests, stress analysis, cost studies, and material specifications are included. S.F.

N81-22983# Argonne National Lab., Ill. Energy and Environmental Systems Div.
METHODOLOGY FOR EVALUATION OF INTERTECHNOLOGY TRADEOFFS
W. A. Buehring, R. G. Whitfield, and T. D. Wolsko Oct. 1980 111 p refs
(Contract W-31-109-eng-38)
(ANL/AA-22) Avail: NTIS HC A06/MF A01

A methodology interface between the impact-assessment process and the decision maker is developed. Problems are characterized by: (1) multiple conflicting objectives; (2) uncertainty; (3) variable outcomes over time; and (4) dynamic behavior. Minimum cost, benefit-cost, and decision analysis are three approaches taken with respect to this type of problem. The recommended methodology has three basic stages: (1) problem formulation; (2) objective hierarchy selection; and (3) alternative evaluation. DOE

N81-22984*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC VEHICLE TEST REPORT CUTLER-HAMMER CORVETTE
Jan. 1981 146 p refs Sponsored by NASA
(Contracts NAS7-100; DE-AI01-78CS-54209)
(NASA-CR-164224; DOE/CS-54209/1) Avail: NTIS HC A07/MF A01 CSCL 05A

Vehicles were characterized for the state of the art assessment of electric vehicles. The vehicle evaluated was a Chevrolet Corvette converted to electric operation. The original internal combustion engine was replaced by an electric traction motor. Eighteen batteries supplied the electrical energy. A controller, an onboard battery charger, and several dashboard instruments completed the conversion. The emphasis was on the electrical portion of the drive train, although some analysis and discussion of the mechanical elements are included. Tests were conducted both on the road (actually a mile long runway) and in a chassis dynamometer equipped laboratory. The majority of the tests performed were according to SAE Procedure J227a and included maximum effort accelerations, constant speed range, and cyclic range. Some tests that are not a part of the SAE Procedure

J227a are described and the analysis of the data from all tests is discussed. DOE

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-22985 California Univ., Santa Cruz.
LATE TIME OPTICAL SPECTRA FROM THE Ni-56 MODEL FOR TYPE 1 SUPERNOVAE Ph.D. Thesis
Timothy Stephen Axelrod 1980 252 p
Avail: Univ. Microfilms Order No. 8107707

The hypothesis that the optical luminosity of Type 1 supernovae results from the radioactive decay of Ni56 synthesized and ejected by the explosion was investigated by numerical simulation of the optical spectrum resulting from a homologously expanding shell composed initially of pure Ni56. This model, which neglects the effects of material external to the Ni56 core, is expected to provide a reasonable representation of the supernova at late times when the star is nearly transparent to optical photons. The numerical simulation determines the temperature, ionization state, and non-LTE level populations which result from energy deposition by the radioactive decay products of Ni56 and Co56. The optical spectrum includes the effects of both allowed and forbidden lines. Dissert. Abstr.

N81-22986 California Inst. of Tech., Pasadena.
SPECTROSCOPY AND SPECTROPHOTOMETRY OF CATACLYSMIC VARIABLE STATS Ph.D. Thesis
Richard Alan Wade 1981 141 p
Avail: Univ. Microfilms Order No. 8107278

Distances and luminosities of individual cataclysmic variable stars (as opposed to statistical properties of the group as a whole) is acquired by studying the secondary stars of these short period binary systems. Since the secondary stars are of late spectral type, observations in the near infrared are especially useful. Spectrophotometry of the dwarf nova U Geminorum was carried out from 0.3 to 1 microns using the Hale 5m telescope. The energy distribution is interpreted as the sum of fluxes of an M4.5 or M5 star and a source giving a flat continuum. The M companion, referred to as U Gem B is less dense than a main sequence star of the same color index. The absolute spectrophotometry allows a distance modulus of 4.4 + or - 0.8 mag to be derived for U Geminorum. The absolute visual magnitude of the quiescent system is about Mv = 10.3. The Na 1 infrared double in the spectrum of U Geminorum has been observed at high resolution around the orbit. Dissert. Abstr.

N81-22987 California Inst. of Tech., Pasadena.
OPTICAL SPECTRAL PROPERTIES OF ACTIVE GALACTIC NUCLEI AND QUASARS Ph.D. Thesis
Howard Kwong Chew Yee 1981 115 p
Avail: Univ. Microfilms Order No. 8107279

Four separate investigations dealing with the properties of optical continuum and emission-lines of active galactic nuclei (AGN) and quasars are presented. Multichannel scans of 3CR radio galaxies are decomposed by using a two-component model an elliptical galaxy and a power-law nonthermal component. There is a strong correlation between the luminosity of the power-law component and the strength of the Balmer emission-lines. In most cases, by extrapolating to the Lyman continuum, the power-law models derived provide enough ionizing radiation to account for the Balmer line strengths. Extending the study of radio galaxies to include Seyfert galaxies and quasars, there is a strong continuity between broad-line AGN's and quasars in terms of similarities in the correlations between line luminosities and nonthermal continuum luminosity. Dissert. Abstr.

N81-22988# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
A SEARCH FOR RAPID VARIABILITY IN EIGHT QUASARS AND BL LACERTAE OBJECTS
Bradley E. Schaefer 1978 10 p refs
(CSR-HEA-80-3) Avail: NTIS HC A02/MF A01

Data are presented on the results of a photographic patrol of eight quasars between November 1977 and April 1978. The quasars observed are 3C120, PKS0735+178, PKS0736+017, OJ287, ON325, W Com = ON321, 3C273, and OQ208. Four of the objects were observed ten to twenty times within a week. The source of the comparison sequence and the observed magnitudes of each object are listed, and data for PKS 0735+178, ON325, and 3C273 are graphed. Four of the objects were observed ten to twenty times within a week. PKS0735+178 was found to vary significantly in brightness on a time scale of weeks. J.D.H.

N81-22989*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
X-RAY BURSTERS AND THE X-RAY SOURCES OF THE GALACTIC BULGE
Walter H. G. Lewin and Paul C. Joss 1 Sep. 1980 150 p refs Submitted for publication
(Contract NAS5-24441; Grants NSF AST-78-21993; NsG-7643)
(NASA-CR-164240; CSR-HEA-80-8) Avail: NTIS HC A07/MF A01 CSCL 03A

Type 1 X-ray bursts, optical, infrared, and radio properties of the galactic bulge sources, are discussed. It was proven that these burst sources are neutron stars in low mass, close binary stellar systems. Several burst sources are found in globular clusters with high central densities. Optical type 1 X-ray bursts were observed from three sources. Type 2 X-ray bursts, observed from the Rapid Burster, are due to an accretion instability which converts gravitational potential energy into heat and radiation, which makes them of a fundamentally different nature from Type 1 bursts. E.A.K.

N81-22990# Netherlands Committee for Geophysics and Space Research, Amsterdam.
SPACE RESEARCH IN THE NETHERLANDS, 1979
1980 38 p refs Presented at 23rd COSPAR Meeting, Budapest, 2-14 Jun. 1980
Avail: NTIS HC A03/MF A01

Observations of cosmic and solar X-ray radiation, studies of proton flares, and work in ultraviolet and infrared astronomy are described. Gamma ray and X-ray astronomy experiments using satellites and balloons are reported on. Ultraviolet photometry from the Astronomical Netherlands Satellite as well as infrared observations from balloons, aircraft and satellites are mentioned. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-22991 California Univ., San Diego.
BROAD ABSORPTION-LINE QSOS Ph.D. Thesis
Vesa Tapio Junkkarinen 1980 112 p
Avail: Univ. Microfilms Order No. 8107465

Photoionization and radiative transfer in gas near a QSO is considered for conditions appropriate for producing broad absorption. The spectrophotometry of PHL 5200 indicates no substantial changes in the appearance of the absorption troughs over a five year period. The minimum velocity with respect to the emission line system for the absorbing gas is 200 + or - 250 km/s. The residual flux where L alpha absorption is expected is used to obtain a rough estimate that the ion number density ratio HI/SiIV is approximately 2. The depth of CIV absorption yields an upper limit of 0.1 for the fraction of sky covered by the absorbing region. This assumes a single absorbing region

with velocity increasing with radius. The spectra of UM139, UM141, UM232, UM275, Q1246-057, and RS 23 are also discussed. Dissert. Abstr.

N81-22992 Michigan Univ., Ann Arbor.
THE MAGNETIC FIELDS OF WHITE DWARF STARS: ASTRONOMICAL POLARIMETRY AND A LABORATORY INVESTIGATION OF THE CONTINUUM POLARIZATION MECHANISM Ph.D. Thesis
Douglas Nason Brown 1980 349 p
Avail: Univ. Microfilms Order No. 8025656

Broadband optical circular polarization measurements were made for several white dwarfs, X-ray sources and central stars of planetary nebulae. The consistency between the magnetic field strength and geometry inferred from Zeeman effect measurements of GD 90 and the null circular polarization results was checked theoretically by assuming the Zeeman inferred magnetic characteristics and the appropriate model atmosphere from the grid of Wehrse. The magnetically induced circular polarization was then predicted as a function of wavelength by an approximate radiative transfer calculation. The result demonstrates that the observed low limit on the circular polarization can be explained with these assumptions only by invoking the strong polarization effect of the Balmer absorption edge. An investigation which demonstrates the applicability of experimental polarimetric results obtained from the study of non LTE arc plasmas to the study of white dwarf atmospheres is also discussed. Dissert. Abstr.

N81-22993 State Univ. of New York at Albany.
CALCULATIONS OF THE LIGHT SCATTERED BY RANDOMLY ORIENTED ENSEMBLES OF SPHEROIDS OF SIZE COMPARABLE TO THE WAVELENGTH Ph.D. Thesis
Richard Warren Schaefer 1980 247 p
Avail: Univ. Microfilms Order No. 8107667

Asano and Yamamoto's (1975) solution of the scattering by homogeneous spheroids of size comparable to the wavelength was checked and used to calculate selected results. The entire solution was rederived as a check and presented in detail as a guide to further development. Test results between the computer code developed here and that of Asano's show good agreement; in addition, results from two other recently developed theoretical methods agree with the corresponding results here to within published accuracy. Results are shown for the scattering by a selection of randomly oriented ensembles of spheroids. All six independent elements of the Mueller matrix along with the extinction, scattering, and phase lag cross-sections and the asymmetry factors were calculated. From the calculations here and previous results reported by other authors, the scattering by spheroids is discussed and characterized. Dissert. Abstr.

N81-22994*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
FAR-INFRARED ROTATIONAL EMISSION BY CARBON MONOXIDE
Christopher F. McKee, J. W. V. Storey, Dan M. Watson, and Sheldon Green 1981 29 p refs Prepared in cooperation with California Univ., Berkeley
(Grants NGR-05-003-511; NsG-7105; NSF AST-79-23243)
(NASA-TM-82316) Avail: NTIS HC A03/MF A01 CSCL 03B

Accurate theoretical collisional excitation rates are used to determine the emissivities of CO rotational lines 10 to the 4th power/cu cm < n(H2), 100 K< T < 2000 K, and J < 50. An approximate analytic expression for the emissitivities which is valid over most of this region is obtained. Population inversions in the lower rotational levels occur for densities n(H2) approximately 10 (to the 3rd to 5th power)/cu cm and temperatures T approximately > 50 K. Interstellar shocks observed edge on are a potential source of millimeter wave CO maser emission. The CO rotational cooling function suggested by Hollenbach and McKee (1979) is verified, and accurate numerical values given. Application of these results to other linear molecules should be straightforward. Author

N81-22995*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MEASUREMENT OF THE 0.511 MeV GAMMA RAY LINE FROM THE GALACTIC CENTER
J. O. D. Jardim, J. L. Benson, M. V. A. Jardin, and I. M. Martin Feb. 1981 8 p refs Presented at the 2d Reunion Latino-Am. de la Union de Astron. Intern., Merida, Venezuela Sponsored by NASA Submitted for publication Sponsored in part by Fundo Nacional de Desenvolvimento Cientfico e Technologico
(NASA-CR-164130; INPE-2004-RPE/286) Avail: NTIS HC A02/MF A01 CSCL 03B

The detection of the 0.511 MeV electron positron annihilation line coming from the Galactic Center to provide the means to estimate the rate of positron production and to test some theoretical sources of positrons is addressed. The results of the measurements of the 0.511 MeV line flux made with a gamma ray experiment on board a stratospheric balloon are presented. The detector field of view looked at the galactic longitude range -31 deg < l(II) < +41 deg. The observed flux is 0.0067 (+ or - 0.0005) photons 1/cm(2)5 which is in very good agreement with the expected flux when assuming that the Galactic Center is a line source emitting uniformly. M.G.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-22996* National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY SCIENCE RESULTS OF VOYAGER 1 SATURN ENCOUNTER
Don Bane 30 Mar. 1981 10 p
(NASA-News-Release-81-44; P81-10044) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

Preliminary science results of the Voyager 1 encounter of the planet Saturn are reported. On August 22, 1980, the spacecraft was 109 million km (68 million mi) from Saturn. Closest approach to Saturn took place on November 12, at 3:46 p.m. (PDT), when the spacecraft passed 126,000 km (78,000 mi) from the cloud tops. Measurements of the atmosphere, wind speed, radiation, six surrounding rings, and the planet's old and newly found satellites were recorded. The encounter ended December 15, 1980. The spacecraft took more than 17,500 photographs of Saturn and its satellites. E.A.K.

N81-22997 California Univ., Santa Cruz.
AN INFRARED AND OPTICAL STUDY OF SULFUR AND NEON ABUNDANCES IN PLANETARY NEBULAE Ph.D. Thesis
Harriet Lenore Dinerstein 1980 96 p
Avail: Univ. Microfilms Order No. 8107708

Forbidden emission lines in the optical one micron, and mid infrared spectral regions were observed in a large sample of planetary nebulae, in order to measure abundances of all the predominant ions of sulfur and neon. The ionization of sulfur is not equivalent to that of oxygen although their ionization potential are nearly identical. The ionization correction factor commonly used to estimate the sulfur abundance overestimates the abundance by a factor of three to ten. A better prediction is found by taking into account the low photoionization cross section of S++, although other factors such as charge transfer reactions may be important also. The ionization connection factor for neon appears to be more accurate although the neon data are less complete. Sulfur abundances do not vary by more than 40% among planetary nebulae of widely varying positions and ages, not between planetary nebulae and the present interstellar medium. Dissert. Abstr.

N81-22998*# Texas Univ. at Dallas. Center for Space Sciences.
ANALYSIS OF DATA FROM VIKING RPA'S Final Technical Report, 1 Mar. 1979 - 31 Dec. 1980
W. B. Hanson May 1981 30 p refs

(Grant NsG-7599)
(NASA-CR-164192) Avail: NTIS HC A03/MF A01 CSCL 03B

Measurements of the martian ionosphere performed by Viking Retarding Potential Analyzer (RPA) are reported. Viking RPA measurements of low energy electron fluxes out to 16,000 km above the Mars surface are discussed including both energy spectra and periods of continuous monitoring of the total flux above 15 ev. The mean electron current at energies greater than ev increases montonically by nearly two orders of magnitude from about 9000 km down to 700 km, but no clear signature of the bow shock is seen. The total wave power in the 2 sec measurement intervals for this current does, however, show a broad peak near 1700 km altitude. These variations in the low energy electron fluxes are related to whistler mode oscillations in the solar wind plasma. It is concluded that there may be a highly turbulent shock structure that masks a clear signature of the bow shock in the time averaged data. E.A.K.

N81-22999*# Texas Univ. at Dallas, Richardson.
ANALYSIS OF DATA FROM THE PIONEER VENUS SOUNDER PROBE MASS SPECTROMETER Semiannual Status Report, Oct. 1980 - Mar. 1981
John H. Hoffman May 1981 9 p refs
(Grant NAGW-64)
(NASA-CR-164213) Avail: NTIS HC A02/MF A01 CSCL 03B

The composition of the lower atmosphere of the planet Venus from 62 km to the surface was measured by a neutral gas mass spectrometer onboard of the Pioneer Venus Sounder Probe. Fifty-one mass spectra were obtained with an average altitude resolution of approximately 1 km. The instrument measured the composition of the gases relative to CO2, the dominant gas, that is sampled from the Venus atmosphere through a special leak. The mass range extended from 1 to 208 amu with a sensitivity of the order of 1 ppm relative to CO2, but for the noble gases it was nearly 100 times better. A description of the instrument and the initial results are reported. E.A.K.

N81-23000*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF THE METHOD OF DISCRETE ORDINATES TO THE SOLUTION OF THE TRANSPORT EQUATION IN THE CASE OF AN INHOMOGENEOUS PLANETARY ATMOSPHERE
L. V. Zasova and Ye. A. Ustinov Jun. 1980 19 p refs Transl. into ENGLISH of "Primeneniye Metods Diskretnykh Ordinat K Resheniyu Uravneniya Perenosa v Sluchaye Neodnorodnoy Planetnoy Atmosfery" Rept. Pr-377 Inst. of Space Research, Academy of Sciences (USSR), Moscow, 1977 19 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3198)
(NASA-TM-76204; Pr-377) Avail: NTIS HC A02/MF A01 CSCL 03B

A version of the method of discrete ordinate (MDO) which can be used for an optically thick inhomogeneous atmosphere was developed. The MDO may be implemented as an algorithm simpler than those proposed earlier. The algorithm is the same for each azimuth dependent component of intensity. The MDO can determine the scattered radiation field over its entire length along the vertical. It is shown the MDO, when used for homogeneous atmospheres is in agreement with the results obtained by other methods. E.A.K.

N81-23001*# Arizona Univ., Tucson. Lunar and Planetary Lab.
SPECTROPHOTOMETRY OF PLANETS, ASTEROIDS AND SATELLITES FROM THE INTERNATIONAL ULTRAVIOLET EXPLORER SATELLITE Final Technical Report, 1978 - 1980
M. G. Tomasko, B. Zellner, S. Martinek, and T. Gehrels 1 May 1981 37 p refs
(Grant NsG-5249)
(NASA-CR-164244) Avail: NTIS HC A03/MF A01 CSCL 03B

A total of 14 8 hour I.U.E. observing sessions resulted in 39 spectra of 11 asteroids and 9 solar type stars as well as 57 spectra at various locations on the disk of Jupiter. The Jupiter observations include a total of 5 center to limb series of spectra at various latitudes and a North South series along the central meridian. In the range from 2000-3000 A, the planet shows a striking decrease in brightness at latitudes greater than about 30 degrees, and exhibits limb brightening at low latitudes and limb darkening at high latitudes. Preliminary results indicate that about 6 km-amagats of clean hydrogen are required above a haze of absorbing aerosols to reproduce the limb brightening observed at 2500 A in the equatorial regions. At higher latitudes, the aerosols extend to even higher levels of the atmosphere. Comparison of the Jovian data with detailed model calculations and the analyses of the asteroid spectra are still in progress with other support. A.R.H.

N81-23002*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REPORT OF WORKSHOP ON METHODOLOGY FOR EVALUATING POTENTIAL LUNAR RESOURCES SITES
Richard J. Williams and Norman Hubbard Feb. 1981 59 p refs Workshop held at Houston, Tex.
(NASA-TM-58235; JSC-17058) Avail: NTIS HC A04/MF A01 CSCL 03B

The type and quantity of lunar materials needed to support a space power satellite program was used to define the type and quality of geological information required to certify a site for exploitation. The existing geological, geochemical, and geophysical data are summarized. The difference between these data and the required data for exploitation is used to define program requirements. Most of these requirements involve linear extensions of existing capabilities, fuller utilization of existing data, or expanded use of automated systems. Author

N81-23003# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
BALLOON VERSUS AIRCRAFT FOR RESEARCH ON MARS
Harry O. Ruppe Feb. 1980 7 p refs
(TUM-LRT-TB-80/30) Avail: NTIS HC A02/MF A01

Simple theoretical considerations taking displaced volumes, gas densities, device mass, and gravity into consideration are used to investigate the aptitudes of balloons and aircraft. Although apparently more complex, aircraft operation is shown to be more feasible in the Martian atmosphere. The characteristics of this atmosphere make balloon flight at an altitude of 3 km equivalent to Earth flight at on altitude of 35.7 km. Aircraft flight, however, in the Martian atmosphere at an altitude of 1 km is only equivalent to Earth flight at an altitude of 13.2 km. A hydrazine engine powered aircraft is proposed. Author (ESA)

N81-22409*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF A WINDOW PROTECTION ASSEMBLY FOR A SHUTTLE EXPERIMENT
Obie H. Bradley, Jr. *In* NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 303-329 (For primary document see N81-22388 13-39)
Avail: NTIS HC A19/MF A01 CSCL 14B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-23004* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ATLAS OF SOLAR SPECTRA BETWEEN 1175 AND 1950 ANGSTROMS RECORDED ON SKYLAB WITH THE NRL'S APOLLO TELESCOPE MOUNT EXPERIMENT
Leonard Cohen Mar. 1981 566 p
(NASA-RP-1069) Avail: SOD HC $31.00 CSCL 03B

Spectra of selected solar regions were recorded by the Naval Research Laboratory slit spectrograph on the Apollo Telescope Mount aboard Skylab. This atlas of those spectra is intended as a guide to the formulation of experiments and analysis of data

obtained by extreme ultraviolet spectrographs and may be valuable to investigators analyzing International Ultraviolet Explorer spectra and data from Solar Maximum Mission and High Resolution Telescope Spectrograph. The slit spectrograph was used to cover the range 1175 A to 1950 A with a spectral resolution of 0.06 A and a spatial resolution at Sun center of 2 deg by 30 deg. Microdensitometer tracings of spectra from (1) a quiet region, (2) an active region, (3) a coronal hole, and (4) a flare are included and were computer processed to include the characteristic curve of the film. Line identifications for prominent features are included as well as a reference scale permitting the user to obtain absolute intensities. J.M.S.

N81-23005*# Stanford Univ., Calif. Inst. for Plasma Research.

AN INTERACTING LOOP MODEL OF SOLAR FLARE BURSTS

A. Gordon Emslie Mar. 1981 33 p refs
(Grants NGL-05-020-272; NAGw-92; Contract N00014-75-C-0673)
(NASA-CR-164216; SU-IPR-831) Avail: NTIS HC A03/MF A01 CSCL 03B

As a result of the strong heating produced at chromospheric levels during a solar flare burst, the local gas pressure can transiently attain very large values in certain regions. The effectiveness of the surrounding magnetic field at confining this high pressure plasma is therefore reduced and the flaring loop becomes free to expand laterally. In so doing it may drive magnetic field lines into neighboring, nonflaring, loops in the same active region, causing magnetic reconnection to take place and triggering another flare burst. The features of this interacting loop model are found to be in good agreement with the energetics and time structure of flare associated solar hard X-ray bursts. A.R.H.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-23006*# Science Applications, Inc., Huntsville, Ala.

A SURVEY OF SPACE RADIATION EFFECTS

C. W. Hill 18 Mar. 1980 31 p refs
(Contract NAS8-32387)
(NASA-CR-161687; SAI-81-555-HU) Avail: NTIS HC A03/MF A01 CSCL 03B

The effects of space radiation and its significance for space missions, as they increase in scope, duration, and complexity are discussed. Type of radiation hazard may depend on location or on special equipment used. It is emphasized that it is necessary to search for potential radiation problems in the design stage of a mission. Problem areas such as radiation damage to solar cells and the revolutionary advances are discussed. Radiation effect to electronics components other than solar cells, and several specialized areas such as radioactivity and luminescence are also examined. E.A.K.

N81-23007# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

ENERGETIC-PARTICLE POPULATIONS AND COSMIC-RAY ENTRY Interim Technical Report

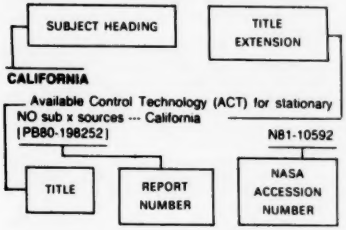
Michael Schulz 17 Mar. 1981 80 p refs
(Contract F04701-80-C-0081)
(AD-A096970; TR-0081(6960-05)-7; SD-TR-81-13) Avail: NTIS HC A05/MF A01 CSCL 04/1

This report constitutes a review of recent progress in the study of charged-particle access, transport, and loss with respect to the Earth's magnetosphere. A major objective of studying particle access is to identify the sources of trapped and quasi-trapped radiation. Important progress in this area involves the measurement of comparative ionic abundances in the radiation belts. The historic problem of accounting for cosmic-ray cut-off latitudes as a function of particle energy is being solved by the adoption of increasingly realistic and accurate models of the magnetospheric B field. Progress in the estimation of particle-transport coefficients (mainly diffusion coefficients) involves the measurement of fluctuating electric and magnetic fields on the ground, at balloon altitudes, and in space. The importance of particle interactions with discrete waveforms (as distinguished from broad-banded spectral noise) is increasingly being recognized. For example, the unsteady magnetospheric convection associated with substorms contributes importantly to radial diffusion, whereas cyclotron resonance with chorus elements and other discrete excitations may contribute importantly to pitch-angle diffusion and (thus) to the loss of energetic particles from the magnetosphere. The role of man-made signals such as radio transmissions and power-line harmonics in this latter process remains uncertain and continues to be debated. GRA

99 GENERAL

No abstracts in this category.

Typical Subject Index Listing



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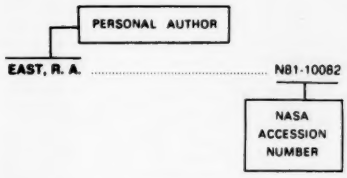

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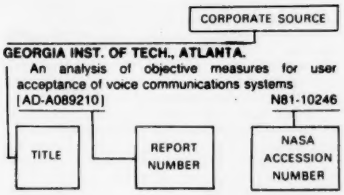

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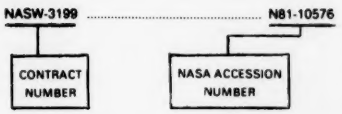

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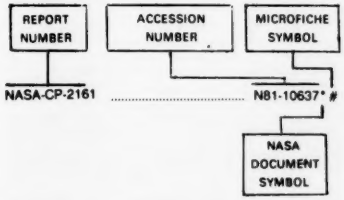

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